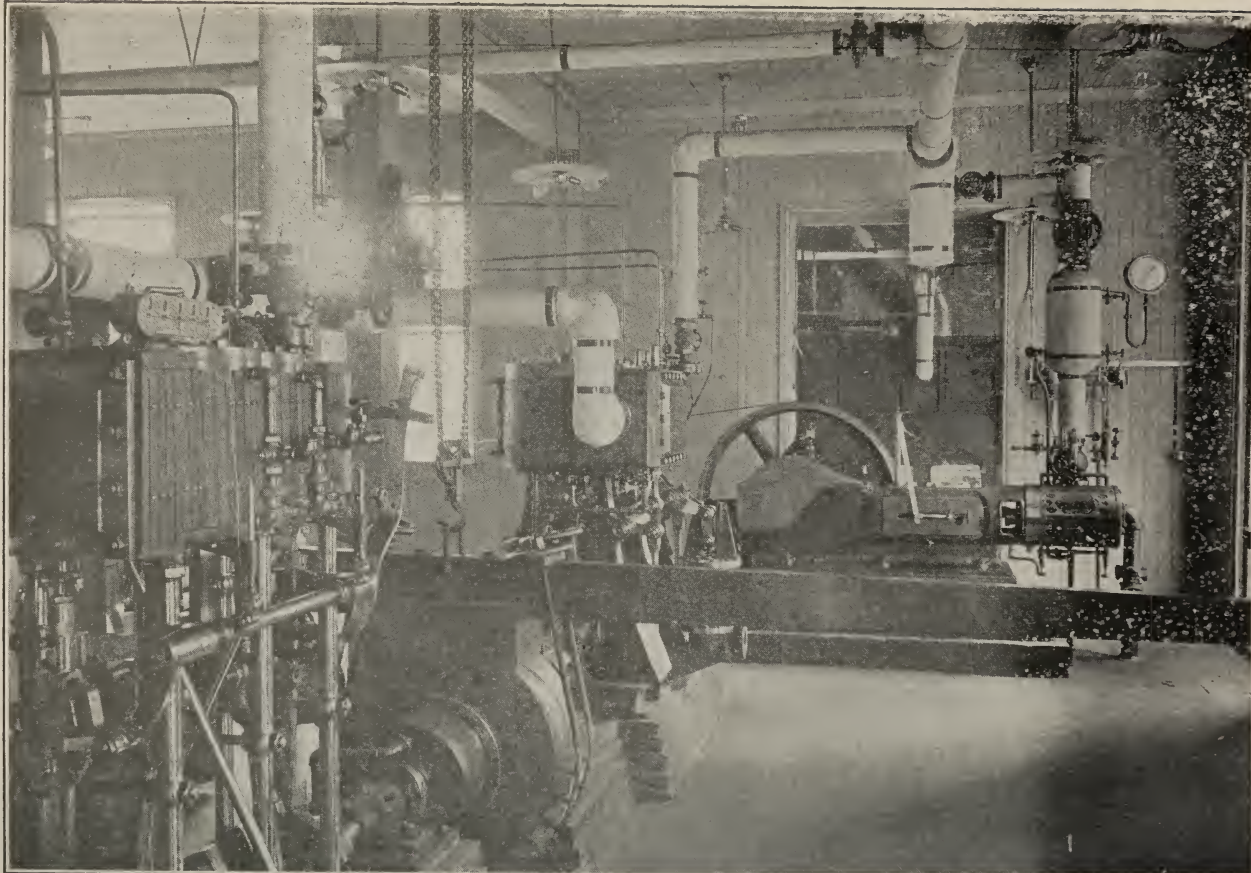
REGISTER

OF THE

Baltimore Polytechnic Institute

1909-1910



ENGINE AND BOILER PLANT, MECHANICAL LABORATORY.

ANNUAL REGISTER

—OF THE—

Baltimore Polytechnic Institute

311—331 COURTLAND STREET.

TWENTY-FIFTH
ACADEMIC YEAR

1909-1910

CONTENTS

BALTIMORE POLYTECHNIC INSTITUTE.

HISTORICAL SKETCH.

The Baltimore Polytechnic Institute, the second manual training school established in the United States as a part of a public school system, is one of the several educational institutions of the secondary grade maintained by the City of Baltimore.

Although it is believed that tentative efforts to engraft manual training upon the city's school system were made as early as 1873 or 1874, yet the action which led to the establishment of this school was not taken until April, 1883. At a meeting of the Board of Commissioners of Public Schools, held on the 24th of that month, Mr. Joshua Plaskitt, Commissioner for the Ninth Ward, offered a resolution for the appointment of a committee "to consider . . . the advisability of establishing a school or schools for manual training." The resolution was adopted, and the committee thus appointed recommended the establishment of a school "for manual education." The necessary enabling ordinances and enactments having been passed by the City Council of Baltimore and the General Assembly of Maryland, the school was organized and opened on February 26th, 1884, under the name of "Baltimore Manual Training School," with Dr. R. Grady as Director.

In January, 1886, the faculty was reorganized, Lieut. John D. Ford, an officer of the Engineer Corps of the United States Navy, who had been detailed for duty at the school, becoming Principal.

From the opening of the school applicants for admission had been required to pass through the eighth grammar school grade, or to show satisfactory evidence of having had equal instruction; but in September, 1888, it was de-

cided to admit pupils of the 6th, 7th and 8th grammar grades. This action opened the school to so large a number of young boys that increased accommodations became imperative, and in June, 1890, a new building, devoted to the academic studies and drawing, was finished and occupied.

Lieut. Ford was recalled to the naval service in June, 1890, and was succeeded as Principal by John W. Saville, a retired member of the Engineer Corps of the Navy.

In May, 1893, the name of the school was changed to "Baltimore Polytechnic Institute," and the title of Principal and Vice-Principal to President and Vice-President respectively.

Mr. Saville resigned in August, 1899, and was succeeded as President by Lieut. William R. King, Engineer Corps, U. S. N., the present head of the school.

The new charter of Baltimore, which went into effect on March 1st, 1900, provides that the mayor of the city shall appoint, as the head of the Department of Education, a Board of School Commissioners composed of nine persons, to serve without pay, and to be chosen from among those citizens he deems "most capable of promoting the interests of public education, by reason of their intelligence, character, education, or business qualifications." The names of the distinguished citizens now serving as Commissioners will be found on page

Another provision of the Charter requires that "in order to secure the continuance of local interest in, and oversight of the public schools, there shall be appointed by said Board of School Commissioners such number of unpaid School Visitors as may be found requisite."

The members of the original Board of Visitors had no sooner acquainted themselves with the general conditions prevailing in the school—the age and attainments of the pupils of the lower grades, the character of the work done, and the scope of the curriculum—than they submitted to the Board of School Commissioners a very comprehensive and exhaustive report discussing the conditions, needs, and

aims of the school, and recommending certain changes in the requirements for admission, and in the curriculum. The partial adoption of this report in September, 1900, excluded grammar school pupils from the Institute, thus making the standard for admission the completion of the course prescribed for the Elementary Schools.

In April, 1901, a further consideration of the report of the Board of Visitors led to the practical addition of one year to the course by permitting graduates to remain for a year of post-graduate work; and in May, 1902, the length of the course was, by action of the Board, set at four years for pupils entering on and after September 15, 1902.

It was further provided that pupils leaving the Institute before the completion of the course should receive certificates of the work done by them up to the time of their withdrawal.

By operation of the new Charter the titles of President and Vice-President were changed, in 1900, to Principal and Vice-Principal.

BOARD OF SCHOOL COMMISSIONERS.

JOHN E. SEMMES, *President.*
ALCAEUS HOOPER,
REV. WLLIAM ROSENAU,
THOMAS McCOSKER,
EDWARD ROSSMAN,

GEORGE A. SOLTER, Jr.,
ROBERT M. ROTHER.

EOARD OF VISITORS.

ABRAM H. COLMARY, *Chairman*,
FREDERICK W. WOOD,
FREDERICK J. MAYER,
JAMES L. MURRILL,
WILLIAM H. ROTHROCK,
MENDES COHEN,
FREDERICK H. WAGNER.

SUPERINTENDENT OF PUBLIC INSTRUCTION.

JAMES H. VAN SICKLE.

RECORD OF THE FACULTY AND STAFF.

Arranged in Order of Appointment.

William R. King, Passed Assistant Engineer, U. S. N. (retired), U. S. N. A., 1875. Principal and Head of Department of Engineering, September 1, 1899.

William H. Hall, B. C. C., 1885; A.M., Washington College, 1906. Assistant in Department of Science, September 23, 1886; Head of Department of Science, September 13, 1899.

William G. Richardson, Assistant in Department of Engineering, February, 1887.

J. Ward Willson, B. C. C., 1861; M.D., Baltimore University, 1889. Assistant in Department of English and Modern Languages, March 21, 1888.

George M. Gaither, B. M. T. S., 1888. Asssitant in Department of Engineering, April 1, 1889; Supervisor of city manual training centers in addition to Institute duties, September, 1902

Warren S. Seipp, B. M. T. S., 1891. Assistant in Department of Engineering, September, 1891.

Samuel M. North, B. C. C., 1887. Assistant in Department of Mathematics, September, 1894; Head of Department of English and Modern Languages, September 13, 1899.

Samuel P. Platt. Assistant in Department of Engineering, October 1, 1897.

Oliver Bacharach, B. C. C., 1897. Assistant in Department of Mathematics, April, 1898.

J. Edward Broadbelt, B. M. T. S., 1890; Ph.G., Maryland College of Pharmacy, 1893. Ass'stant in Department of Science, September, 1898.

John H. Bramble, B. C. C., 1897. Assistant in Department of Mathematics, October, 1899.

J. Montgomery Gambrill, B. P. I., 1897. Assistant in Department of English, June 11, 1902; resigned in 1904 to become Assistant State Superintendent of Education in Maryland; Head of Department of History and Civics, September, 1906.

Charles Ernest Conway, B. P. I., 1902. Assistant in Department of Engineering, June 11, 1902; at Lehigh Unviersity, 1903-1904; Assistant in Department of Engineering, September, 1907.

William L. DeBaufre, B. P. I., 1903; E.E., Lehigh University, 1907; M.E., Lehigh University, 1909. Assistant in Department of Engineering, September, 1903; at Lehigh University, 1904-1905; Assistant in Department of Engineering, 1905-1906; at Lehigh University, 1906-1907; Assistant in Department of Engineering, January 1, 1908.

Irving L. Twilley, A.M., Washington College, 1892. Assistant in Department of English, September, 1903; transferred to Department of Science, June, 1904.

Henry A. Converse, A.B., Hampden-Sidney College, 1893; Ph.D., Johns Hopkins University, 1903. Assistant in Department of Mathematics, May, 1904; resigned, September 1, 1906, to accept the chair of Mathematics at Davis and Elkins College; Assistant in Department of Science, June, 1908; Acting Head of Department of Mathematics, February 10, 1909; Head of Department of Mathematics, September, 1909.

Edward Reisler, A.M., Western Maryland College, 1888. Assistant in Department of English, May, 1904.

Elmer M. Harn, A.B., Rock Hill College, 1892; A.M., Rock Hill College, 1895. Assistant in Department of English, July, 1904.

Isaac L. Otis, A.B., New York University, 1899. Assistant in Department of English, September, 1904; Assistant in Department of History and Civics, September, 1906.

Allan L. Malone, B. P. I., 1902. Assistant in Department of Engineering, October 1, 1904.

Rowland Watts, A.B., Washington College, 1886; A.M., Washington College, 1888. Assistant in Department of Science, September, 1905; Head of Department of Mathematics, September, 1907; transferred to Department of Science, February 10, 1909.

Allan B. Souther, B.S., Harvard, 1907. Assistant in Department of Engineering, October, 1905.

Harvey S. Housekeeper, A.B., Lehigh University, 1872. Assistant in Department of Mathematics, September, 1906.

Henry Bogue, Jr., A.B., Johns Hopkins University, 1899. Assistant in Department of Engineering, September, 1906.

Thomas F. Garey, A.B., Washington College, 1904; A. M., Washington College, 1907; LL.B., University of Maryland, 1907. Assistant in Department of Mathematics, November, 1906.

George S. Wills, Ph.B., University of North Carolina, 1896; A.M., Harvard, 1898. Assistant in Department of English, June 3, 1907.

William H. Wilhelm, A.B., B.S., St. John's College, 1893; A.M., St. John's College, 1896. Assistant in Department of Mathematics, June 12, 1907.

James B. Arthur, B. P. I., 1904. Assistant in Department of Science, September 25, 1907.

William P. Stedman A.B., Trinity College, 1905. Assistant in Department of English and Modern Languages, February 12, 1908.

Joseph Ellis Hodgson, A.B., Washington and Lee, 1898. Assistant in Department of Mathematics, June, 1908.

John H. Hills, B. P. I., 1905; M.E., Lehigh University, 1908. Assistant in Department of Engineering, June, 1908.

Emanuel Fritz, B. P. I., 1905; M.E., Cornell University, 1908. Assistant in Department of Engineering, June, 1908.

Charles Frederick Ranft, A.B., Johns Hopkins Univeristy, 1902. Assistant in Department of History and Civics, June, 1908.

Philip Dougherty, B.S., Trinity College, 1907. Assistant in Department of History and Civics, June, 1908.

George N. Anderson, Pratt Institute, 1908. Assistant in Department of Engineering, September, 1908.

Powhatan Clarke, M.D., University of New York, 1858. Assistant to the Principal, September 1, 1908.

Nathan Lebovitz, Secretary, February 11, 1909.

Clarence P. Bolgiano, B. P. I., 1908. Laboratory Assistant, September, 1909.

Wilson N. Gambrill, B. P. I., 1909. Graduate Assistant in Department of Engineering, September ,1909.

Frederick B. Abbott, B. P. I., 1909. Graduate Assistant in Department of Engineering, September, 1909.

Laurance F. Magness, B. P. I., 1907. Assistant in Department of Engineering, September, 1909.

Joseph E. Green, B. C. C., 1905; A.B., Johns Hopkins University, 1908. Assistant in Department of English, September, 1909.

J. Irving Tracey, Sc.B., Dickinson College, 1906; Graduate Student in Mathematics, Johns Hopkins University, 1908-1910. Assistant in Department of Mathematics, September, 1909.

Albert B. Haupt, B. C. C., 1906; A.B., Johns Hopkins University, 1909. Assistant in Department of Mathematics, October, 1909.

FACULTY.

WILLIAM R. KING, *Principal,*
Head of Department of Engineering.

WILLIAM H. HALL,
Head of Department of Science.

SAMUEL M. NORTH,
Head of Department of English and Modern Languages.

J. MONTGOMERY GAMBRILL,
Head of Department of History and Civics.

HENRY A. CONVERSE,
Head of Department of Mathematics.

DR. POWHATAN CLARKE,
Assistant to the Principal.

NATHAN LEBOVITZ,
Secretary.

FACULTY AND STAFF BY DEPARTMENTS.

DEPARTMENT OF ENGINEERING.

William R. King, *Head of Department.*

William L. DeBaufre,
Charles E. Conway,
John H. Hills,
Samuel P. Platt,
Henry Bogue, Jr.,
Allan B. Souther,
William G. Richardson,
Emanuel Fritz,
Allen L. Malone,
George M. Gaither,
Warren S. Seipp,
George N. Anderson,
Laurance F. Magness,
Wilson N. Gambrill,
Frederick B. Abbott.

DEPARTMENT OF MATHEMATICS.

Henry A. Converse, *Head of Department.*

John H. Bramble,
Oliver Bacharach,
William H. Wilhelm,
Harvey S. Houskeeper,
Thomas F. Garey,
Joseph E. Hodgson,
J. Ibving Tracey,
Albert B. Haupt.

DEPARTMENT OF SCIENCE.

William H. Hall, *Head of Department.*

Rowland Watts,
J. Edward Broadbelt,
Irving L. Twilley,
James B. Arthur,
Clarence P. Bolgiano.

DEPARTMENT OF ENGLISH AND MODERN LANGUAGES.

Samuel M. North, *Head of Department.*

J. Ward Willson,
Edward Reisler,
Elmer M. Harn,
William P. Stedman,
George S. Wills,
Joseph E. Green.

DEPARTMENT OF HISTORY AND CIVICS.

J. Montgomery Gambrill, *Head of Department.*

Isaac L. Otis,
Charles F. Ranft,
Philip Dougherty.

CALENDAR FOR SCHOOL YEAR 1909-1910.

September 14, Tuesday	Opening of Session.
November 19, Friday	First Quarter ends.
November 22, Monday	Second Quarter begins.
November 25, Thursday	Thanksgiving Day.
December 24, Friday	Christmas Vacation begins.
January 3, Monday	Session resumed.
Januuary 28, Friday	Semi-annual Examinations begin.
February 11, Friday	Second Quarter ends.
February 14, Monday	Third Quarter begins.
February 22, Tuesday	Washington's Birthday.
March 24, Thursday	Easter Vacation begins.
March 29, Tuesday	Session resumed.
April 1, Friday	Third Quarter ends.
April 4, Monday	Fourth Quarter begins.
April —, ———	Arbor Day.
May 18, Wednesday	Annual Examinations begin.
May 30, Monday	Decoration Day.
June —, Tuesday	Commencement Day.
September 13, Tuesday	Opening of Session.
November 18, Friday	First Quarter ends.
November 21, Monday	Second Quarter begins.
November 24, Thursday	Thanksgiving Day.
December 23, Friday	Christmas Vacation begins.

COURSE OF STUDY AND GENERAL STATEMENT OF PLAN AND PURPOSE.

The course of study for the Baltimore Polytechnic Institute is designed to accomplish the following purposes:

1. To give a sound fundamental education to pupils whose inclinations and other circumstances preclude a college course.

2. To give to youth that healthful and highly valuable manual training which broadens education, and conduces to dexterity, contrivance, and invention.

To this end, the time usually devoted to Greek and Latin is employed, during two years of the course, in carpentry, sheet-metal, and light forge exercises. The exercises cover what is known as Manual Training, and are given with special reference to their educational value.

3. To give to students in the third and fourth years such studies in Engineering, Mathematics, Physics, and Chemistry, and such mechanical exercises in Applied Manual Training as will fit them:

(a) For immediate and remunerative employment in the wide field of civil, mechanical, and electrical engineering, where, it is believed, their training will lead to rapid advancement.

(b) For entrance to advanced standing into a higher institution of technology, should a higher technical education be desired.

For the attainment of these objects there is one carefully planned general course of study, no effort being made to specialize until the fourth year, by which time a student will have acquired a considerable degree of practical skill and intimate knowledge in some one of the professions based on mechanical art and applied science that he may

have elected to follow. Thus, in the fourth year in the subject of Design, the student may select examples of mechanical, electrical, or civil engineering design, the amount of such practice being limited only by the capacity of the student and the time available. Extra opportunities in the laboratories are offered advanced students for more extended investigations than those demanded by the course.

No attempt is made to teach trades, but the equipment is of such nature that the instruction given in the shops is designed to be correlative to the work of the classroom, and results are aimed at that will insure success in mechanical pursuits subsequent to graduation. It is believed that instruction in correct methods of using tools, and practical illustrations of how, and for what purpose, things are done, are of more value than mere excellence in hand skill.

In the Department of English and Modern Languages, instruction in English is given during the first, second, and third years. The course comprises: (a) A review of grammar; (b) systematic study and practice in composition and rhetoric; and (c) reading and study of the works of representative British and American authors, including the college entrance requirements. The instruction in German during the first and second years, and in French during the third year, is designed to give a reading, rather than a speaking, knowledge of these languages, in order to meet entrance requirements of higher institutions of technology.

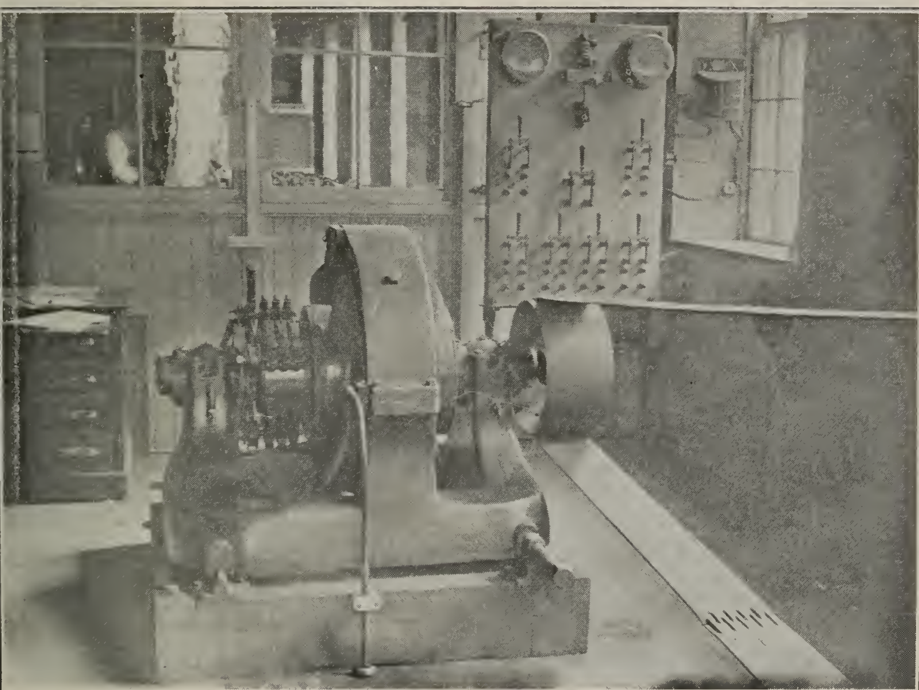
In the Department of History and Civics, instruction is given during the first and second years. The course includes about one-half the work prescribed by the Committee of Seven, the first year being devoted to English History, and the second year to American Hsitory and Civics.

In Mathematics, care is taken at the beginning of the first year to discover and correct any defects in fundamental training, after which the course of instruction proceeds in Algebra, Geometry, Trigonometry, Analytic Geometry,

Descriptive Geometry, and the Differential and Integral Calculus, the completeness of the course enabling the graduate to read understandingly a treatise on any of the mechanical sciences.

In the Department of Science, the work of the second and third years in Physics embraces the properties of matter and elementary mechanics, the instruction being accompanied with lectures illustrated by experiments and with practical work in the laboratory. The instruction of fourth year students in this subject is confined to Heat and Electricity. The dynamic theory of heat, the conversion of heat into mechanical work, and the thermodynamics of the steam engine are the particular features of the fourth year in the study of Heat.

In Electricity, the work of the fourth year consists of practical applications of the theoretical study of the second and third years, and of commercial electricity. Electric lighting, both arc and incandescent, is discussed from constructive and economic standpoints, and the advantages of high tension distribution of electric power are demonstrated. The dynamo and motor are treated in detail — operating, designing, and winding being carefully considered. The experimental equipment for this work consists of a twenty-five kilowatt generator, built by the students; a one-half horsepower alternating current motor coupled to a twenty-five volt multipolar generator; and several small machines of various types. These appliances, with the electric light equipment of the Institute, present opportunities for the operation of electrical machinery and for the detection of defects and faults to be overcome. Alternating currents are treated both mathematically and experimentally, and converters, motors, impedance coils, and measuring instruments are used by students for verifying laws and descriptions given in lectures. The switchboard and the generator plant afford opportunities for power station practice, and the electric railway is treated in a practical manner. The newest and best methods of telegraph and telephone construction are presented, the tele-



DYNAMO AND SWITCHBOARD, MECHANICAL LABORATORY.

phones of the Institute being installed on the common battery plan. Special features of the course are the various tests for insulation resistance of conductors, the tests for grounds, faults and short circuits on lines, and the treatment of the defects in the dynamo and motor, and remedies therefor.

For the study of chemistry there are chemicals and apparatus in the laboratory to give to the third year students instruction concerning the nature and reaction of the chemical elements and their compounds, and to students of the fourth year a brief course in qualitative and quantitative analysis, the compounds formed in the various reactions and their chemical equations being particularly emphasized.

In the Department of Engineering, the instruction given the fourth year students in theoretical and applied mechanics embraces the laws of equilibrium and motion; centre of gravity; friction; principles of work; moment of inertia; mechanics of materials; graphic statics; and an elementary study of the stresses and deformations produced in standard specimens of metal when subjected to tension, compression, and shearing. The work of the third and fourth year students in steam engineering consists of the study of thermodynamics of the steam engine in a manner as comprehensive as the facilities of the Institute and the maturity of the students permit. Numerous calculations are made involving engine and boiler efficiencies and proportions, and the study of the indicator is supplemented with practice in taking diagrams, from which the consumption and distribution of the steam and the power of the engine are determined. The advantages and disadvantages of the different kinds of steam boilers are studied, particular attention being given to boiler attachments. The plant for this work consists of an inverted triple expansion engine of 100 I. H. P., an inverted compound engine of 60 I. H. P., a high-speed automatic cut-off engine (Harrisburg Standard) of 46 I. H. P., a horizontal power engine of 25 I. H. P., a Campbell & Zell sectional boiler (rated at

100 horse-power), and a Roberts safety water tube boiler capable of generating steam for the production of 120 I. H. P. when used in connection with the triple expansion engine. The engines mentioned above were built by the students, the first two after designs of the Bureau of Steam Engineering of the Navy Department, and there is now in course of construction by the students a four cylinder, 30 H. P., gasoline engine of the Autocar type. Grouped in the mechanical laboratory are all the engines, the 25 K. W. generator, the swithchboard controlling the lighting installation of the Institute, a Riehle testing machine of 50,000 pounds capacity, and apparatus for calibrating pressure gauges, thermometers, and indicator springs. The compound and triple expansion engines may be worked singly or together in connection with a friction dynamometer specially designed at the Institute, an internal circulation of water in the brake wheel enabling the engine to run continuously in making power tests. The Roberts boiler is installed in a room immediately connected with the laboratory, and furnishes steam at 150 pounds pressure per square inch for the stage expansion engines, and at 95 pounds and 40 pounds to the high-speed and power engines respectively, Foster regulators reducing the pressure as desired. Horizontal and vertical separators are placed in the steam pipes to insure the delivery of dry steam to the engines, and connections are made for calorimeter tests. The surface condenser used in connection with the stage expansion engines may also be connected with the exhaust of the high-speed engine when desired. The water from condensation is delivered to a filter of approved design by a Knowles independent air pump, and thence direct to the boiler either by a Knowles duplex pump or Pemberthy injector. Exhaustive engine and boiler tests for power and efficiency are made by squads of fifteen of the senior class, the results of which are recorded in standard forms and retained by the students.

In the mechanical drawing room are 175 tables of approved design, and an equipment of instruments and mod-

els well adapted to the requirements of an advanced course in the subject. Third year students are required to make a free-hand sketch of the parts of some machine, from which a finished drawing, tracing, and blue print are made. The work of the fourth year students in design tends to make them draftsmen in the true sense—not mere copyists.

The equipment in the machine, pattern, forge, sheet metal, and carpentry shops is equal to that of any similar institution in the country.

THE COURSE OF INSTRUCTION IN DETAIL.

The course extends over the usual period of ten months, but after deducting holidays and the time allowed for examinations, it is found that not more than thirty-two consecutive weeks remain for instruction.

The course as here outlined in detail applies to all entries after January 31, 1910, though the students in the Institute who entered previous to that date are pursuing an equivalent course. It is believed that the new arrangement will be more effective, as it advances the modern languages one year, that is, to the first, second, and third years from the second, third, and fourth; and concentrates physics in the second and third years in preference to distributing the subject through the first, second, and third years.

Students completing the full course of the Institute have invariably obtained full sophomore standing with some sophomore credits in the courses leading to the degrees of C.E., M.E., and E.E., at Cornell and Lehigh Universities.

DEPARTMENT OF ENGINEERING AND APPLIED MECHANICS.

FIRST YEAR COURSE — D CLASS

Mechanical Drawing.— 32 weeks, 4 periods a week:
Use of instruments; lettering; elementary lessons.

Practice.— 32 weeks, 4 periods a week:

(a) Carpentry; 16 weeks, 4 periods a week:
Lectures and exercises in laying out, cutting, framing, and joining wooden members.

(*b*) Sheet Metal; 16 weeks, 4 periods a week:
Lectures and exercises in soldering, and in sheet metal and venetian iron work.

SECOND YEAR COURSE — C CLASS.

Mechanical Drawing.— 32 weeks, 4 periods a week:
Hatching; tinting; neatness and accuracy; scale drawing; intersection and development of surfaces.

Practice.— 32 weeks, 4 periods a week:

(*a*) Carpentry; 4 weeks, 4 periods a week:
Review of the work of the first year.

(*b*) Pattern Making; 12 weeks, 4 periods a week:
Exercises in wood turning and in making simple patterns.

(*c*) Forge Work; 8 weeks, 4 periods a week:
Light forging and welding.

(*d*) Vise Work; 8 weeks, 4 periods a week:
Exercises in chipping and filing.

THIRD YEAR COURSE — B CLASS.

Steam Engineering.— 32 weeks, 4 periods a week:

Types of boilers; boiler details; boiler room auxiliaries; the steam engine; engine details; indicating and governing; governors; valves; condensers; multiple expansion engines; theories of heat; thermodynamics; properties of perfect gases; properties of saturated steam; use of steam tables; combustion of fuel and steam generation; boiler and engine efficiencies; the engine mechanism; slide valve and link motion.

Mechanical Drawing.— 32 weeks, 4 periods a week:

Detail drawings of machines from free-hand sketches; the working drawing, tracing and blue print. Descriptive Geometry (see course in Mathematics).

Practice.— 32 weeks, 4 periods a week:

(*a*) Pattern Shop; 16 weeks, 4 periods a week:
Exercises in making patterns for wrenches, pulleys, eccentrics, pillow-blocks, gears, globe valves, pipe joints, and core boxes where necessary. Lectures on construction and finish of patterns, and on the different kinds of molding, the mixing of iron and brass, and the operation of the cupola.

(*b*) Machine Shop; 14 weeks, 4 periods a week:
Casehardening, and work on the lathe, planer, milling machine, drill-press, and vise.

(*c*) Forge Shop; 2 weeks, 4 periods a week:
Forging and tempering machine cutting tools.

FOURTH YEAR COURSE — A CLASS.

The Steam Engine.— 20 weeks, 3 periods a week:

The indicator and indicator diagram; measurement of power and of steam consumption; expansion of perfect gases and of steam; the ideal and actual engine; engine and boiler design; valve diagrams; engine and boiler testing; the steam turbine.

The Internal Combustion Engine.— 12 weeks, 3 periods a week:

Gaseous fuels; oil engines; types of explosive engines; operation and management of the explosive engine.

Mechanics.— 32 weeks, 5 periods a week:

Kinematics: Motion in a straight line with constant velocity and with constant acceleration; space, velocity, and acceleration curves; vectors; resolution and composition of displacements, velocities, and accelerations; relative motion; acceleration with variation in direction of velocity; angular motion.

Dynamics: (a) Statics: The parallelogram, triangle, and polygon of forces; composition and resolution of forces; friction; the inclined plane; the screw; parallel forces; moments of forces and of couples; conditions of equilibrium; method of sections; equilibrium under the action of three forces; centre of gravity. (b) Kinetics: The laws of motion; inertia, mass, weight, momentum; work and power of a force and of a torque; potential and kinetic energy; principles of work; centrifugal and centripetal forces.

Mechanics of Materials: Stress; strain; elastic limit; ultimate strength; bending and resisting moments; moment of inerita; radius of gyration; simple and cantilever beams; struts; deflection; torsion; resilience; bending-moment and shear diagrams

Graphic Statics: The funicular polygon; the reciprocal diagram for determining stresses in framed structures.

Mechanics of Machinery: Transmission of power by means of belts and toothed gears; theory and action of pumps.

Mechanical Drawing and Design.—32 periods, 4 periods a week:

Mechanical Drawing. The drafting accompanying the work in design; freehand sketches, working drawings, tracing, and blue prints.

Design: Proportioning of machine parts, such as spur, bevel, and worm gearing, belt pulleys, and bearings, from empirical and rational formulas. The application of the mechanics of materials to the design of some part of an engine or tool, such as cylinder, connecting rod, valve, screw jack. The use of the Zeuner diagram in valve design. The application of graphic statics to the design of a roof truss or bridge member. Students are permitted to select a subject for design from a list of mechanical and electrical devices submitted to them.

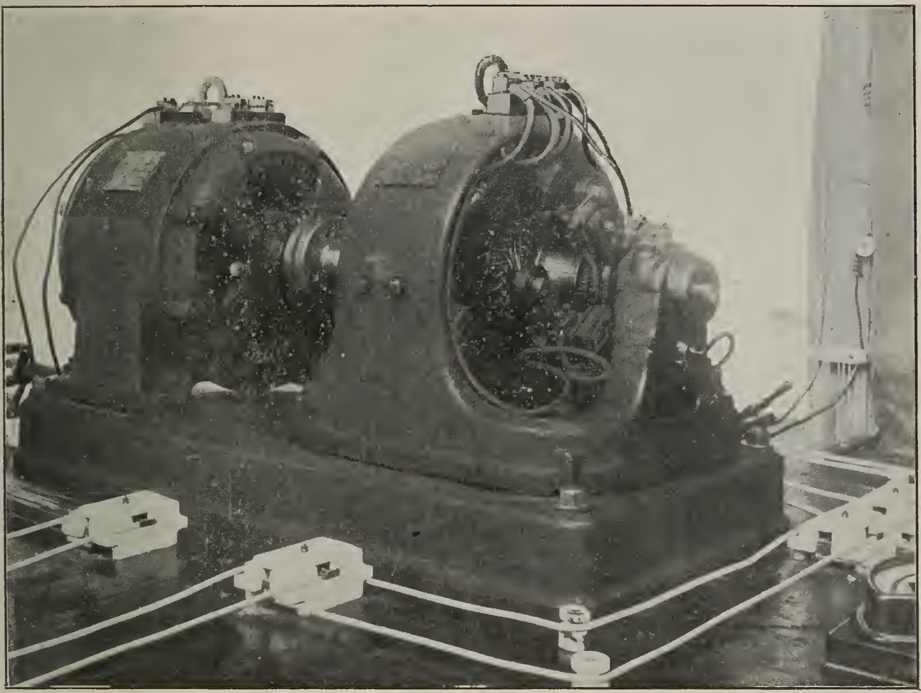
Practice.— 32 weeks, 4 periods a week:

(*a*) Machine Shop; 16 weeks, 4 periods a week:

Machine work involving accuracy and finish, such as gear cutting, building and assembling of mahcinery.

(*b*) Engineering Laboratory; 16 weeks, 4 periods a week:

Tension, compression, and bending tests with a Riehle machine; calibration of pressure gauges, thermometers, and indicator springs; calorimeter tests for quality of steam; valve setting; determining clearance; duty of steam pumps; indicated steam consumption of engines; economy tests of engines and boilers.



WESTINGHOUSE MOTOR GENERATOR.

USED IN LABORATORY.

DEPARTMENT OF MATHEMATICS.

FIRST YEAR COURSE — D CLASS.

Algebra.— 32 weeks, 4 periods a week:

Definitions and notation; fundamental operations; integral linear equations; factoring; highest common factor; least common multiple; fractions; fractional equations; simultaneous linear equations; graphical representation; inequalities; involution; evolution; theory of exponents; surds; quadratic equations.

Geometry.— 32 weeks, 3 periods a week:

Geometry of the straight line and circle; proportion; properties of similar figures; original execrises.

Explanation and Demonstration.— 32 weeks, 1 period a week:

The most difficult and important features of the course are explained and demonstrated.

SECOND YEAR COURSE — C CLASS.

Algebra.— 32 weeks, 3 periods a week:

Review; theory of quadratic equations; variables and limits; indeterminate equations; ratio and proportion; logarithms; variation; arithmetical, geometrical and harmonic progressions; binomial theorem; undetermined coefficients.

Geometry.— 16 weeks, 3 periods a week, and 8 weeks, 4 periods a week;

Areas and volumes; lines and planes in space; polyhedrons; cylinder; cone; sphere; original exercises.

Trigonometry.— 8 weeks, 4 periods a week.

Functions of the acute angle; the right triangle; use of tables; functions of any angle; relations between the functions of several angles; inverse trigonometric functions.

THIRD YEAR COURSE — B CLASS.

Trigonometry.— 16 weeks, 3 periods a week.

General formulas; oblique triangle; miscellaneous examples.

Surveying.— 16 weeks, 2 periods a week:

Instruments and their uses; land surveying.

Analytic Geometry.— 32 weeks, 4 periods a week:

The straight line; circle; parabola; ellipse, hyperbola; transformation of co-ordinates; construction of loci; higher plane curves.

Descriptive Geometry.— Time taken from mechanical drawing, as it is taught in connection with that subject:

Projections; problems in straight line and plane; projections and sections of solids; curved surfaces and tangent planes; development and projection of screw thread; intersection of surfaces.

FOURTH YEAR COURSE — A CLASS.

Differential and Integral Calculus.—32 weeks, 5 periods a week:

Differentiation of algebraic and transcendental functions; successive differentiation; expansion of functions, including the development of Maclaurin's and of Taylor's theorems; evaluation of indeterminate forms; mode of variation of functions of one variable, including geometric problems in maxima and minima; differentiation of functions of more than one variable; radius of curvature; tangents and normals; derivatives of arcs, areas, volumes, and surfaces of revolution; fundamental rules and methods of integration; geometrical applications of the calculus to lengths of curves, to areas, to volumes of solids of revolution; integration of trigonometric functions; successive integration; applications to mechanics.

DEPARTMENT OF SCIENCE.

SECOND YEAR COURSE — C CLASS.

General Physics.— 32 weeks, 4 periods a week.

During this year the regular high school course in Physics is covered. Derivation of formulae and the solution of problems are required. Emphasis is laid upon such sections as have reference to engineering courses. Experimental demonstration by the instructor is made whenever the subject permits. One period a week is devoted to individual work in the laboratory.

THRD YEAR COURSE — B CLASS.

Electricity and General Physics.— 32 weeks, 4 periods a week:

Magnetism; galvanometers and other measuring instruments; laws of electrical action; magnetic and electrical units; simple alternating currents; derivation of formulae and practical problems; experimental demonstration by the instructor; individual laboratory work in electrical measurements.

The year in physics is confined principally to advanced study of light and sound, the subjects of dynamics and heat being embraced in the work of the Department of Engineering.

Chemistry.—32 weeks, 2 periods a week:

Recitations in general chemistry with experimental work by the instructor, showing the preparation and reactions of the elements and compounds. Individual work in the laboratory.

FOURTH YEAR COURSE — A CLASS.

Electricity.— 32 weeks, 4 periods a week:

Lectures and recitations in applied electricity, including electro-chemical action; principles of the generator, motor, and transformer; railways; line and machine testing; telegraph and telephone; electric lighting. One period a week is devoted to individual laboratory work in measurements, practical testing, and the operation of the generator, motor, and transformer.

Chemitry.—32 weeks, 4 periods a week:

General Chemistry: Practice in stoichiometry; lectures illustrating the theory of chemical action and emphasizing the parts of the subject bearing upon engineering work.

Analytic Chemistry: Qualitative and quantitative analysis, the work of the fourth quarter consisting in the determinations of the substances affecting the quality of iron and steel.

DEPARTMENT OF ENGLISH AND MODERN LANGUAGES.

FIRST YEAR CORUSE — D CLASS.

Review of English Grammar.—16 weeks, 2 periods a week:

Composition and Rhetoric.—32 weeks, 2 periods a week:

Study of text and frequent written exercises based upon Narration and Description; letter writing.

Literature.—16 weeks, 2 periods a week; and 16 weeks, 4 periods a week:

(*a*) Study of the following selections: Sketch Book; Snow Bound; Tales of the White Hills; Poems and Tales from Poe; Sir Launfal; Lays of Ancient Rome; Lady of the Lake; Ivanhoe.

(*b*) Leading facts in the lives of the authors represented in (*a*).

German.— 32 weeks, 3 periods a week:

Study of the grammar and reading.

SECOND YEAR COURSE — C CLASS.

Composition and Rhetoric.—32 weeks, 2 periods a week:

Frequent written exercises; study of rhetorical principles.

Literature.—16 weeks, 3 periods a week; and 16 weeks, 2 periods a week:

(*a*) Study of the following selections: Ancient Mariner; Vicar of Wakefield; Deserted Village; Silas Marner; DeCoverley Papers; Merchant of Venice; Palgrave (in part).

(*b*) Leading facts in the lives of the authors represented in (*a*).

German.— 32 weeks, 3 periods a week:

Composition; grammar; reading standard German fiction and simple scientific prose.

THIRD YEAR COURSE — B CLASS.

Literature and Composition.— 32 weeks, 3 periods a week:

Study of the following texts: Julius Caesar; Macbeth; Milton's L'Alegro, Il Penseroso, Lycidas, and Comus; Washington's Farewell Address; Webster's First Bunker Hill Oration, or Burke's Speech on Conciliation. Frequent written exercises.

French.— 32 weeks, 3 periods a week:

Study of grammar; composition; reading simple literary and scientific prose.

FOURTH YEAR COURSE — A CLASS.

Technical Compositions.— 32 weeks, 1 period a week.

DEPARTMENT OF HISTORY AND CIVICS.

FIRST YEAR COURSE — D CLASS.

History.— 32 weeks, 5 periods a week:

English History from its beginnings to the present day. Especial attention is given to the social, economic, and political phases of the subject; and as far as time and the maturity of the pupils permit, attention is directed to the development of Europe as it progressed contemporaneously with England.

SECOND YEAR COURSE — C CLASS.

History and Civics.—32 weeks, 4 periods a week:

American History, with special attention to political development; civil government of the United States and the rights and duties of American citizenship.

SENIOR CLASS, MACHINE DESIGN.

Time Devoted to the Different Subjects Comprising the FOUR YEAR COURSE.

	NUMBER OF HOURS PER YEAR.				
	1st Year.	2nd Year.	3rd Year.	4th Year.	Aggregate.
Department of Engineering					
Carpentry	64	16	......	......	80
Sheet Metal	64	......	......	......	64
Vise	......	32	......	......	32
Forge	......	32	20	......	52
Pattern	......	48	64	......	112
Machine	......	......	44	64	108
Mechanical Laboratory	......	......	......	64	64
Mechanical Drawing	128	128	96	......	352
Descriptive Geometry	......	......	32	......	32
Machine Design	......	......	......	128	128
Steam and Gas Engines	......	......	128	96	224
Mechanics	......	......	......	80	80
Mechanics of Materials	......	......	......	80	80
Department of Mathematics.					
Algebra	128	96	......	......	224
Geometry	96	80	......	......	176
Geometry, Analytic	......	......	128	......	128
Trigonometry	......	32	48	......	80
Surveying	......	......	32	......	32
Calculus, Differential	......	......	......	80	80
Calculus, Integral	......	......	......	80	80
Explanation and Demonstration	32	......	......	......	32
Department of Science.					
Physics	......	96	32	......	128
Physics, Laboratory	......	32	......	......	32
Electricity	......	......	64	96	160
Electricity, Laboratory	......	......	32	32	64
Chemistry, Elementary	......	......	32	*96	32
Chemistry, Laboratory	......	......	32	*32	32
Chemistry, Analytic	......	......	......	128	128
Department of English.					
English Grammar	32	......	......	......	32
Composition and Rhetoric	64	64	......	......	128
Literature	96	80	80	......	256
German	96	96	......	......	192
French	......	......	96	......	96
Technical Compositions	......	......	......	32	32
Department of History and Civics.					
History	160	......	......	......	160
History and Civics	......	128	......	......	128
Total	960	960	960	960	3840

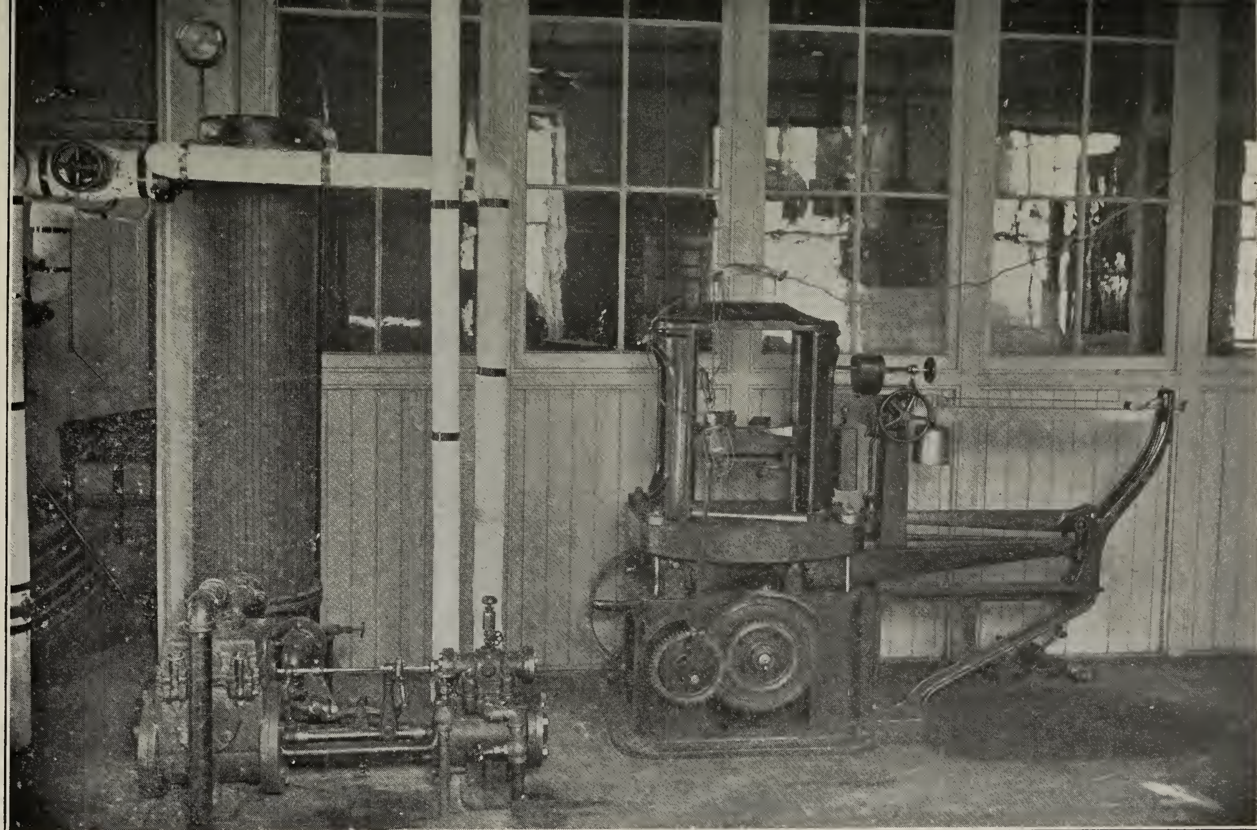
Students preparing for the universities receive instruction in Elementary instead of Analytic Chemistry.

REQUIREMENTS FOR ADMISSION.

Pupils bearing properly attested certificates of having passed the prescribed Grammar School Course of the Public School System of Baltimore are entitled to enrollment.

Other applicants residing in the city will be admitted after passing an examination covering the requirements of the eighth grammar school grade. Eighth grade grammar school pupils who fail of promotion are not eligible for admission under this requirement. Specimen entrance examination papers covering the requirements of the eight grade will be found on pages 67, 68 and 69.

After having successfully passed the entrance examination, a non-resident applicant must register as such at the office of the Secretary of the Board of School Commissioners, where he will be furnished with a bill for the first quarterly installment of the fee, and a presentation at the Institute of a coupon from the bill, signed by the City Comptroller, will be accepted as evidence of payment, and entitle the applicant to enrollment.



CONDENSER AND RIEHLE TESTING MACHINE, MECHANICAL LABORATORY.

MERIT ROLLS.

Merit rolls, showing the proficiency of students in each branch of study, are made out annually for the different classes.

Each subject is assigned a coefficient indicative of its relative weight, and the final mark of a student in a subject (on a scale of 100) is multiplied by its coefficient. The sum of the products thus obtained is the final mark of the student in all the subjects for the year. This mark is a certain percentage of the sum of the coefficients, and such percentage is the student's average for the year.

BALTIMORE POLYTECHNIC INSTITUTE.

Fourth Year Record and Final Merit Roll of Graduating Class of 1909.

Order of Merit.	NAMES.	Date of Admission.	Mechanics.	Mechanics of Materials.	Steam Engineering	Mech. Drawing and Design.	Diff. and Integral Calculus.	Chemistry.	Applied Electricity.	French	Practice.	Deportment.	Aggregate for 1st Year.	Aggregate for 2nd Year.	Aggregate for 3rd Year.	Aggregate for 4th Year.	Aggregate for Four Years.	Graduating Average.
	Maxima.		7	10	10	8	10	10	10	5	5	5	20	40	60	80	200	100
32	F. B. Abbott	1905	5.60	7.90	7.90	6.16	7.90	9.40	8.80	4.60	4.10	4.45	15.73	32.53	46.72	66.81	161.79	80.90
43	O. M. Bloch	1905	5.60	7.00	7.20	5.76	8.00	8.00	7.20	3.65	3.95	0.55	16.39	32.25	49.24	56.91	154.79	77.40
30	G. C. Borst	1905	4.97	7.00	8.00	5.92	7.20	7.90	8.00	3.50	4.00	5.00	17.06	33.81	49.66	61.49	162.02	81.01
*5	F. Burggraf	1905	6.02	9.30	9.30	7.20	9.30	9.30	8.50	4.35	4.45	5.00	16.91	35.13	53.70	72.72	178.46	89.23
†53	C. D. Cann	1905	5.11	7.00	7.00	5.76	8.00	7.40	7.00	3.80	3.20	2.70	13.64	31.06	45.38	56.97	147.05	73.53
12	D. C. Corner	1905	5.04	8.10	7.90	7.04	7.80	8.10	8.30	4.40	4.30	5.00	16.81	34.64	52.46	65.98	169.89	84.95
49	H. W. Crist	1905	4.90	7.00	7.00	5.84	7.10	7.80	7.00	3.50	3.50	5.00	15.51	30.79	45.04	58.64	149.98	74.99
42	W. D. Dalrymple	1905	5.32	7.00	7.30	6.00	7.30	7.90	7.70	4.00	4.05	4.25	16.05	32.63	45.88	60.82	155.38	77.69
*11	L. A. Deliz	1905	4.90	7.00	7.30	6.48	7.50	8.30	7.60	4.60	3.95	5.00	18.24	36.11	53.28	62.63	170.26	85.13
*††7	F. Fahm Jr.	1906	5.74	8.70	8.60	6.48	8.70	9.00	8.50	4.40	4.15	4.50		35.09	52.56	68.77	156.42	86.90
45	C. J. Flayhart	1905	5.04	7.70	7.40	6.00	8.60	8.10	7.50	4.45	4.15	4.75	15.88	30.96	43.36	63.69	153.89	76.95

BALTIMORE POLYTECHNIC INSTITUTE.

FOURTH YEAR RECORD AND FINAL MERIT ROLL OF GRADUATING CLASS OF 1909.

Order of Merit.	NAMES.	Date of Admission.	Mechanics.	Mechanics of Materials.	Steam Engineering	Mech. Drawing and Design.	Diff. and Integral Calculus.	Chemistry.	Applied Electricity.	French	Practice.	Deportment.	Aggregate for 1st Year.	Aggregate for 2nd Year.	Aggregate for 3rd Year.	Aggregate for 4th Year.	Aggregate for Four Years.	Graduating Average.
	MAXIMA.		7	10	10	8	10	10	10	5	5	5	20	40	60	80	200	100
39	R. D. Fleckenstein	1905	4.34	7.00	7.00	5.76	7.00	7.30	7.60	3.50	4.15	5.00	16.50	33.27	48.78	58.65	157.20	78.60
14	G. C. Fultz	1905	5.32	7.50	8.20	6.56	7.60	8.80	8.30	3.90	3.95	5.00	17.53	34.60	52.32	65.13	169.58	84.79
*9	H. N. Gambrill	1904	5.18	7.60	7.80	6.64	7.90	9.20	8.10	4.30	4.25	5.00	16.21	36.32	53.62	65.97	172.12	86.06
*10	W. N. Gambrill	1905	5.67	7.60	8.90	5.76	8.10	9.30	8.70	3.90	4.30	5.00	17.55	34.79	51.58	67.23	171.15	85.58
*4	R. Garcia	1905	5.81	8.20	8.30	6.96	9.00	9.20	8.10	4.70	4.10	4.50	18.73	37.18	55.64	68.87	180.42	90.21
15	G. S. Giles	1905	5.25	8.00	7.50	6.96	6.90	8.30	8.40	3.95	4.40	4.85	15.64	35.76	53.08	64.51	168.99	84.50
*1	J. Glaeser, Jr.	1905	6.23	8.80	9.10	7.28	8.60	9.50	9.00	4.60	4.55	5.00	19.06	37.57	56.46	72.66	185.75	92.88
13	W. T. Hanzsche	1905	5.25	8.50	8.10	6.56	8.50	9.20	8.80	4.20	4.05	5.00	16.63	33.50	51.52	68.16	169.81	84.91
18	E. Heubeck	1905	5.25	7.70	7.60	6.24	7.30	7.80	8.10	3.50	3.85	4.50	17.78	36.04	50.82	61.84	166.48	83.24
47	W. E. Higham	1905	4.90	7.10	7.00	5.92	7.80	7.00	7.20	3.65	4.05	3.20	16.14	32.51	45.84	57.82	152.31	76.16
25	J. R. E. Hiltz	1905	4.55	7.30	7.20	6.08	7.50	8.40	7.60	4.10	3.70	4.75	17.00	34.32	50.62	61.18	163.12	81.56

BALTIMORE POLYTECHNIC INSTITUTE.

FOURTH YEAR RECORD AND FINAL MERIT ROLL OF GRADUATING CLASS OF 1909.

Order of Merit.	NAMES.	Date of Admission.	Mechanics.	Mechanics of Materials.	Steam Engineering	Mech. Drawing and Design.	Diff. and Integral Calculus.	Chemistry.	Applied Electricity.	French	Practice.	Deportment.	Aggregate for 1st Year.	Aggregate for 2nd Year	Aggregate for 3rd Year.	Aggregate for 4th Year.	Aggregate for Four Years.	Graduating Average.
	MAXIMA.		7	10	10	8	10	10	10	5	5	5	20	40	60	80	200	100
31	W. V. Hipsley	1905	5.11	7.70	7.60	6.40	7.00	8.10	8.10	3.85	4.15	5.00	16.39	32.77	49.84	63.01	162.01	81.01
24	F. E. Holland	1905	5.32	8.00	7.60	6.72	7.80	8.30	7.50	4.15	3.80	4.50	16.15	33.21	50.32	63.69	163.37	81.69
50	A. W. Jahn	1904	5.04	7.10	7.10	5.60	7.10	7.40	8.00	3.50	3.75	4.75	15.53	30.76	43.46	59.34	149.09	74.55
41	A. Janushek	1905	4.90	7.10	7.10	6.08	7.00	8.40	7.90	4.05	4.00	5.00	16.02	32.14	45.86	61.43	155.55	77.73
34	E. F. Knabe	1903	5.11	7.60	8.00	6.72	7.30	8.60	8.40	3.95	4.25	4.20	15.55	32.97	47.62	64.13	160.27	80.14
22	R. C. Knipp	1905	5.74	8.00	7.80	6.48	8.20	8.20	7.70	3.85	3.80	4.35	16.95	33.71	50.00	64.12	164.78	82.39
48	G. LaMotte	1905	4.55	7.60	7.10	6.08	7.20	7.80	7.20	3.85	3.75	3.75	16.16	31.78	45.00	58.88	151.82	75.91
26	W. D. Lamdin	1905	5.25	8.20	7.30	6.48	7.80	7.80	8.00	4.45	3.70	4.15	16.25	33.94	49.46	63.13	162.78	81.39
35	G. B. Lohmuller	1905	4.90	7.70	7.50	6.16	7.80	8.40	7.70	3.75	3.65	5.00	16.18	32.41	47.56	62.56	158.71	79.36
‡52	W. J. Mason	1904	4.06	7.00	7.00	4.64	7.10	8.00	7.10	4.35	3.90	4.90	15.90	31.58	45.30	58.05	150.83	75.42
20	R. B. Maxwell	1905	5.18	7.60	8.30	6.32	7.10	8.10	7.90	3.75	3.75	4.25	17.32	34.68	51.46	62.25	165.71	82.86

BALTIMORE POLYTECHNIC INSTITUTE.

Fourth Year Record and Final Merit Roll of Graduating Class of 1909.

Order of Merit.	NAMES.	Date of Admission.	Mechanics.	Mechanics of Materials.	Steam Engineering	Mech. Drawing and Design.	Diff. and Integral Calculus.	Chemistry.	Applied Electricity.	French	Practice.	Deportment.	Aggregate for 1st Year.	Aggregate for 2nd Year.	Aggregate for 3rd Year.	Aggregate for 4th Year.	Aggregate for Four Years.	Graduating Average.
	Maxima.		7	10	10	8	10	10	10	5	5	5	20	40	60	80	200	100
*3	H. C. A. Meyer	1905	6.37	9.50	9.40	7.12	9.10	8.70	9.60	3.55	4.55	5.00	17.40	36.46	54.40	72.89	181.15	90.58
23	J. O. Mirski	1905	4.55	7.40	7.50	6.48	7.10	7.50	7.00	4.10	3.75	4.90	18.37	35.01	50.74	60.28	164.40	82.20
*2	E. H. Niles	1905	5.95	9.30	9.00	6.88	8.60	9.30	9.40	4.85	4.45	4.50	18.52	36.55	53.88	72.23	181.18	90.59
29	W. F. Perkins	1905	4.90	7.40	7.20	6.16	7.10	7.80	7.80	3.50	3.75	4.75	16.82	35.47	49.58	60.36	162.23	81.12
27	F. L. Purdy	1904	5.11	7.60	7.50	6.40	7.00	7.80	7.80	4.10	4.05	4.50	15.60	34.03	51.24	61.76	162.63	81.32
36	H. C. Randall	1905	4.90	7.50	7.10	5.60	7.70	7.80	8.10	3.75	4.00	3.50	16.80	33.33	47.84	59.95	157.92	78.96
51	P. Rosenthal	1904	4.90	7.40	7.00	6.00	7.50	7.80	7.00	3.50	3.60	2.95	14.89	30.56	42.00	57.65	145.10	72.55
28	G. W. Schindhelm	1904	5.60	7.00	8.10	6.40	7.50	9.10	7.90	4.60	4.05	5.00	16.61	32.12	48.42	65.25	162.40	81.20
37	D. W. Shilling	1905	5.53	7.90	7.60	6.40	8.20	8.50	7.90	4.00	4.35	4.45	13.52	33.55	45.62	64.83	157.52	78.76
46	H. B. Siegmund	1905	4.34	7.00	7.00	5.84	7.00	8.20	8.10	3.50	3.95	4.95	15.80	32.45	45.32	59.88	153.45	76.73
33	E. Southerington	1905	5.67	8.20	8.40	6.48	8.00	7.70	8.10	4.35	3.95	5.00	15.47	32.68	46.68	65.85	160.68	80.34

BALTIMORE POLYTECHNIC INSTITUTE.

Fourth Year Record and Final Merit Roll of Graduating Class of 1909.

Order of Merit.	NAMES.	Date of Admission.	Mechanics.	Mechanics of Materials.	Steam Engineering	Mech. Drawing and Design.	Diff. and Integral Calculus.	Chemistry.	Applied Electricity.	French	Practice.	Deportment.	Aggregate for 1st Year.	Aggregate for 2nd Year.	Aggregate for 3rd Year.	Aggregate for 4th Year.	Aggregate for Four Years.	Graduating Average.
	Maxima.		7	10	10	8	10	10	10	5	5	5	20	40	60	80	200	100
21	J. Snyder	1905	4.90	7.30	7.50	6.40	7.80	8.70	8.00	3.50	3.90	4.75	17.77	34.55	50.10	62.75	165.17	82.59
17	F. C. Stauffen	1905	5.39	7.80	8.20	6.48	8.40	8.20	8.30	4.15	4.10	4.70	16.15	33.42	51.96	65.72	167.25	83.63
44	W. F. Tapking, Jr.	1904	5.32	8.20	8.50	6.00	8.10	8.70	7.90	4.20	3.85	3.40	16.08	30.51	43.14	64.17	153.90	76.95
40	L. K. Thompson	1905	4.27	7.80	7.50	6.24	7.30	8.10	7.80	3.50	4.25	4.00	15.69	31.90	47.76	60.76	155.91	77.96
*6	H. B. Tinges	1905	5.88	8.90	7.90	6.80	8.20	9.00	8.90	4.70	4.70	5.00	17.62	36.42	54.06	69.98	178.08	89.04
*‡‡8	M. L. Vincente	1906	5.32	8.10	8.30	6.56	7.90	8.70	7.90	4.55	4.15	5.00		35.45	53.74	66.48	155.67	86.48
38	H. L. Weaver	1905	5.53	7.50	7.30	6.32	8.50	7.60	7.00	4.35	4.10	5.00	15.90	31.71	46.48	63.20	157.29	78.65
19	B. S. Winchester	1905	5.60	8.50	8.40	6.08	7.90	9.00	8.80	4.30	4.40	4.90	17.33	33.30	47.62	67.88	167.13	83.07
16	J. E. Yewell	1905	5.25	8.30	8.10	6.32	8.20	8.80	8.30	3.95	3.95	5.00	16.87	33.28	51.02	66.17	167.34	83.67

* Received 85% or more of the aggregate multiple for the entire course.
† Deficient in Mechanical Laboratory Work; deficiency made up and diploma awarded in September.
†† Entered second year class on credentials from Drexel Institute.
‡ Deficient in Machine Design; deficiency made up and diploma awarded in September.
‡‡ Entered second year class on credentials from High School of San Juan, P. R.

BALTIMORE POLYTECHNIC INSTITUTE.

Fourth Year Record and Final Merit Roll of Mid-Year Graduating Class of 1910.

Order of Merit.	NAMES.	Date of Admission.	Mechanics	Mechanics ap-pl'd to Eng'ng	Steam & Gas Engineering.	Mech. Drawing and Design.	Diff. and Inte-gral Calculus.	Chemistry.	Applied Electricity.	French	Practice.	Deportment.	Aggregate for 1st Year.	Aggregate for 2nd Year	Aggregate for 3rd Year.	Aggregate for 4th Year.	Aggregate for Four Years.	Graduating Average.
	Maxima.		**7**	**10**	**10**	**8**	**10**	**10**	**10**	**5**	**5**	**5**	**20**	**40**	**60**	**80**	**200**	**100**
9	G. E. Gerlach	1905	5.39	8.70	7.60	6.16	8.50	7.70	8.30	4.25	3.95	2.85	15.70	29.58	44.52	63.40	153.20	76.60
12	G. E. Green	1905	4.90	7.00	7.00	6.24	7.00	7.10	7.30	3.65	3.85	4.25	15.22	30.87	45.06	58.29	149.44	74.72
2	F. P. Herrmann, Jr.	1905	5.18	8.30	8.20	6.64	7.80	9.10	8.70	3.90	4.40	4.25	16.01	31.37	52.50	66.47	166.35	83.18
3	E. M. Kennard, Jr.	1905	5.39	8.50	7.40	6.72	9.00	9.60	8.60	4.10	3.95	4.25	14.47	32.46	50.26	67.51	164.70	82.35
†14	A. Mullikin	1905	4.20	7.10	7.00	5.60	7.00	7.40	7.60	3.50	4.00	2.60	15.77	30.63	46.62	56.00	149.02	74.51
†13	A. Nisbet	1905	4.48	7.60	7.00	6.00	7.30	8.30	7.50	3.50	3.70	2.05	16.11	31.87	43.74	57.43	149.15	74.58
4	C. K. Schulte	1905	5.67	9.20	7.50	6.16	8.20	7.80	8.20	3.95	3.95	4.20	16.13	32.28	48.44	64.83	161.68	80.84

BALTIMORE POLYTECHNIC INSTITUTE.

FOURTH YEAR RECORD AND FINAL MERIT ROLL OF MID-YEAR GRADUATING CLASS OF 1910.

Order of Merit	NAMES.	Date of Admission.	Mechanics.	Mechanics ap-pl'd to Eng'ng	Steam and Gas Engineering.	Mech. Drawing and Design.	Diff. and Inte-gral Calculus.	Chemistry.	Applied Electricity.	French	Practice.	Deportment.	Aggregate for 1st Year.	Aggregate for 2nd Year.	Aggregate for 3rd Year.	Aggregate for 4th Year.	Aggregate for Four Years.	Graduating Average.
	MAXIMA.		7	10	10	8	10	10	10	5	5	5	20	40	60	80	200	100
6	J. L. Siems	1905	4.90	8.60	7.80	6.72	7.80	8.60	7.40	4.00	3.95	3.80	16.42	31.75	46.04	63.57	157.78	78.89
1	M. A. Spamer	1905	5.95	8.10	8.20	6.40	8.30	7.40	8.70	4.20	4.30	4.75	17.34	34.16	50.42	66.30	168.22	84.11
5	G. L. Sturmfelsz	1905	4.97	8.00	8.30	6.40	8.10	8.20	8.10	3.80	4.45	4.50	15.82	31.78	47.48	64.82	159.90	79.95
10	W. N. Van Sant	1905	5.04	7.90	7.00	6.56	7.30	7.00	7.80	4.35	3.85	2.10	16.06	32.68	44.56	58.90	152.20	76.10
†15	P. E. Waldschmidt	1905	3.85	8.10	7.50	6.00	7.40	7.80	7.20	3.50	3.85	0.10	14.43	29.98	43.04	55.30	142.75	71.38
11	J. F. Wannenwetsch	1905	4.90	8.10	7.00	6.16	7.20	7.00	7.30	3.50	3.75	3.60	14.84	30.15	46.20	58.51	149.70	74.85
7	R. D. Welsh	1905	5.04	7.10	7.40	6.40	7.30	8.40	7.50	3.50	4.20	4.25	14.98	31.23	49.82	61.09	157.12	78.56
8	C. A. Yockel	1905	4.90	8.70	7.60	6.00	7.00	7.90	8.00	3.55	4.35	4.15	14.98	31.54	45.84	62.15	154.51	77.26

† Deficient in Mechanics; allowed a re-examination, and passed.

ADDRESSES TO GRADUATES.

ADDRESS

To the Graduating Class of 1909 *of the Baltimore Polytechnic Institute, by*

MR. FREDERICK H. WAGNER.

When I received an invitation to appear here this evening and address a few words of admonition to you who are about to pass out into the world of care and labor, I felt highly gratified and honored, for it is just twenty-one years ago this month that I occupied a position such as yours, having been a member of the Class of '87 of your Alma Mater.

We only too often forget our benefactors, and especially so is this the case when we leave the walls which have sheltered us for four years, and where the knowledge which is to be the basis of our future life has been imparted; school days are behind us, so what care we more for the school?

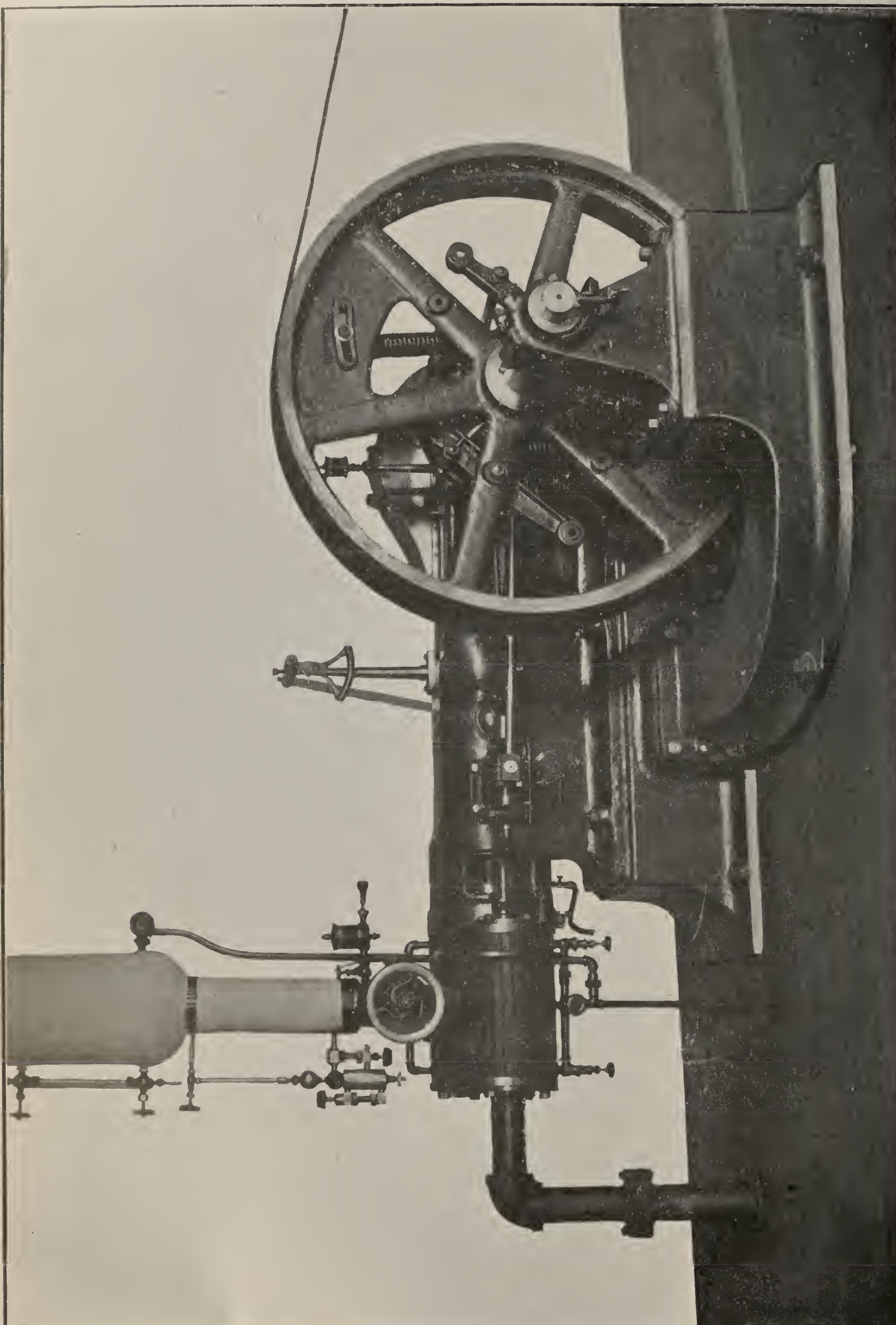
This is a sad mistake, and I would not like to feel that any one of you will live to forget that you owe your Alma Mater support staunch and true, or that you will fail to give her some of the strength which in a measure will become yours as the years roll on, or to countenance anything which will not be for her betterment.

As I stand here now, fond recollections crowd upon me, and I can see many of my class-mates seated as you are, awaiting the moment when we should be free; can see the old building on Courtland Street, where the Manual Training School had its lowly birth, and am proud to picture in my mind the future of the school when the plans of the present School Board have matured and the first fruits of this advanced step are borne and blossom out into added efficiency and honor to the City of Baltimore.

Some of you will no doubt take advantage of the opportunity to secure a higher education, but wherever you go, do not fail to remember your beginning, and for you who remain, I would advise that you place your shoulder to the wheel and assist those who have the interests of this Institution at heart, to place it upon a still higher plane.

The old philosophers inform us that the world's developments pass through three cycles, or periods: The first is, of course, the crude beginning; the second is that in which many modifications and adaptations of the original are utilized for special purposes, but in which case only too often efficiency is sacrificed to expediency; and the third is that in which all the weak features which have come to the fore are eliminated, and a sure progress is made toward the highest efficiency.

This is the true cycle of life, let it be in man, or in a mechanical appliance, or what not. Man in his childhood is but an undeveloped creature, and as the days go by he begins to learn of the nceessities of life, so that by the time he reaches young manhood, he understands what is required of him, and only too often takes what he considers



the royal cut to a certain goal, sacrificing efficiency to expediency, only to find after having reached maturer years that efficiency should be his first consideration, and that in gaining the goal he should not leave undone any of those things which he should have done.

You are now in the first of these three stages; as the days go by you will learn how to apply the knowledge which the friends of the last four years of your Baltimore school life have imparted to you, and you will thus pass into the second stage; but not until you have passed through the fire of costly experience will you reach the third or last stage, in which you can rely upon your judgment and produce the work which your present high ideals strive for.

I know that the ideals of all of you are high, for no young man enters life with other than the most lofty ambition; therefore, do not permit the trials, rebuffs and failures to lure you to an easier trail, but go to the front again and again, until you can compel your superiors and the world at large to acknowledge your worth; and when this last stage has been reached, then give your Alma Mater the credit which is her due.

Your training and education will tell, and if applied properly can only lead to advancement in your chosen profession, as is illustrated by the answer given by a little fellow when asked by his teacher, "What is taught us by the fascinating story of Jonah and the whale?" His answer was, "You cannot keep a good man down."

In admonishing you as to the course to pursue in your future life, I lay great stress upon Diligence. Diligence is a virtue, and as virtues are acquired rather than inherited, it lies within the grasp of all and can therefore be acquired by all. If your future lies in one of the branches of Engineering, hard work and diligence should more than ever be your watchword. The Engineering Profession, like that of law and medicine, is a crowded field today, but there is always room at the top of the ladder for a good man; you will slip and fall more than once, but gather your courage and begin to mount, and never be satisfied until you have reacehd the top-most rung. This can only be accomplished by perseverence and close application to your work, therefore your period of study will only begin when you leave here to-night and enter into the strife where all are striving for the mastery, but where few reach the goal, and these few only through the exercise of diligence. A great lesson lies in the etymology of this word; a man can never permanently exhibit diligence unless he loves his work, hence, when practicable, he should choose the work for which he is best adapted by nature, and then diligence will be to him a comparatively easy task.

Next in line to Diligence, I would recommend Fidelity, another of the acquired virtues, and which means a careful and loyal observance of duty, and performance of obligations. Here I would propose that you always bear in mind the words of the historian, Macaulay, who said "Fi-

delity to a good cause in misfortune had been regarded as a virtue." When you seek employment, and the opportunity is offered you to enter the service of another, be faithful to the trust imposed. Consider well the interests of the employer, be faithful to them, and never waver for a moment from the road which conscience dictates as the one straight path to accomplish that for which you are employed.

Diligence and Fidelity walk hand in hand, and a strict observance of both will bring its own reward. Days may come when you imagine that in spite of all your efforts success has as yet not smiled upon you and you think your employer shortsighted in not seeing your worth.

When this time comes, put forth every effort to convince him by your zeal that Diligence and Fidelity to him are the fountain springs of your being, and the desired result will not be lacking. Do not object to your duties, no matter how insignificant they may appear. Bear in mind that "Whatsoever thy hand findeth to do, do it with all thy might." When your duties become of a higher order and your responsibilities greater, see to it that your actions be such that they can be bared to the world to the satisfaction of those you love.

Benjamin Franklin said: "He that hath a trade hath an estate, and he that hath a calling hath an office of profit and honor; but then the trade must be worked at, and the calling followed, or neither the estate nor the office will enable us to pay our debts."

Industry is a sure preventive of starvation, and always leads to higher and nobler ideals. Some say that "luck" is a predominating influence in life. and that the successful man was a creature of luck. Why? Because this individual had eyes open to see his opportunity, a heart ready to prompt him to well timed action, and the nerve to consummate a perfect work and ideal. He was not a man who permitted the world's foibles to block his path. I might say with Emerson, "There is a time in every man's education when he arrives at the conviction that envy is ignorance; that imitation is suicide; that he must take himself for better or for worse, as his portion; that, though the wide universe is full of good, no kernel of nourishing corn can come to him but through his toil bestowed on that plot of ground which is given him to till."

These are the ideals which I would be pleased to give you in the journey which you begin tomorrow, and always remember that your character shall be framed of the most sterling honesty and scrupulous morality, bearing in mind that the most extravagant notions of integrity are not amiss.

Your education has comprised a course in the Mechanic Arts and in mathematics, chemistry, and physics, supplemented by a practical course of work in the shops, so that your hands might do what your brain devises—an accomplishment so essential to a successful life, for the brains without a means of accomplishment, or vice versa, is nil, for you cannot tell another to do that which you yourself cannot do.

I trust you will all permit your training to grow and flourish until Baltimore shall be proud of your accomplishments, remembering that her citizens by their generosity enabled the establishment of a school of this character. Never tread backwards, never leave well enough alone, but map out a course which you intend to pursue, and then permit no man or other influence to cause your deviation by one hair's breadth from the path which will eventually lead to your goal.

Before closing, permit me to say once more: Do not become discouraged by failures. Failures are the sad lot of all men, but if we can draw wisdom from them, and proceed with renewed vigor to take up again the broken thread, the failures will become less numerous, and the day will come when you can feel that your labor is perfect, and that a failure is practically an impossibility.

Here it is perhaps apropos to mention Paul Lawrence Dunbar's little sonnet, which is well worth remembering:

"I've a humble little motto
That is homely, though it's true—
Keep a pluggin' away.
It's a thing when I've an object
That I always try to do—
Keep a pluggin' away."

My theme, gentlemen, can be summed up into the two words, "Diligence and Fidelity," and I trust that I have not transgressed upon your patience to such an extent that you find the words tiresome, for they should always be your guiding star and hope for the future. These oft repeated words remind me of a story told of a Western politician, who once delivered what seemed to him an excellent and striking speech on the trust question, and he was most anxious to ascertain its effect upon the Democratic portion of his audience, who for the most part were sturdy Irishmen.

"Was the speech to your liking, Pat?" he asked an old friend in the audience.

"Sure, it was a grand speech!" averred Pat, in a tone of such sincere admiration that the politician felt moved to investigate further.

"Was there any part of it more than the other that seemed to hold you?" the speaker asked.

"Well, now that you ask me, I'll tell you," responded Pat. "What took me most, sir, was your perseverance—the way you went over the same thing again and again."

ADDRESS

To the Mid-Year Graduating Class of 1910 *of the Baltimore Polytechnic Institute, by*

DR. JOHN B. WHITEHEAD, ASSOCIATE PROFESSOR OF ELECTRICITY, JOHNS HOPKINS UNIVERSITY.

An address to a graduating class always fills me with sympathy for the class. It is as though their alma mater were taking one last crack at them—and on an occasion when they are more or less on exhibition and therefore defenceless. Now I question whether advice and admonition are ever welcome; certainly they are never less so than when they keep us from a class supper. Three times in my experience I have been partially at least the object of a graduation address. Each time I have no doubt it was a good one, full of wise counsel; but I would find it difficult now to remember who the speakers were, much less what they said, and if they had any effect on my subsequent career I am not aware of it.

Now I feel that our good friend, Lieut. King and his able associates have made such good use of their opportunities of telling these young men exactly how everything should and should not be done, that I do not feel inclined to offer any feeble attempt of my own for comparison, nor to risk the good opinion of those who are about to eat by offering them a lemon as the first course.

Rather, ladies and gentlemen, I wish to give you very briefly some idea of how important to your life and comfort it is that there be an increasing number of young men trained in such schools as the Baltimore Polytechnic Institute. I do not feel that many of us realize how dependent we are in our daily life on the man who knows how to "make it work" and to "keep it working." Never in history has there been a period with such wealth of scientific achievement as the present. The adaptation of the truths of science to the use and comfort of man has become a part of the country's commercial frenzy. Investigators in perfectly appointed university laboratories, and manufacturing companies relying on improvements and novelties as their chief weapons in commercial competition, are forces for a progress which often renders the methods of yesterday obsolete today.

To bring these facts prominently to mind it is only necessary to consider such common conveniences as the telegraph, the telephone and the various methods of transportation, leaving as less conspicuous though no less important the improvements in methods of heating, lighting, cooking, cleaning and other domestic activities.

It now requires a shipwreck such as that of the "Republic" or the "Kentucky" of the other day to bring the wonders of wireless telegraphy before us; five years ago it was a scientific curiosity—today every pas-

senger ship is equipped with it, and it is in every day use for communication across the ocean.

The telephone never loses its wonders for me — a familiar voice over hundreds of miles, infinitely farther than the carrying distance of the voice itself — and then within a minute to reach any friend you may choose in a large city! Think of the perfection of apparatus and method necessary to render this possible. And now we have with us the automatic telephone which has no central station operators — you press the necessary buttons and your friend answers.

In transportation we have steam and electric railroads, the automobile and the airship as triumphs of technical knowledge and skill whether it be in their construction or their operation. The steam locomotive is holding its own manfully against its electric rival and for many purposes will continue to do so for a long time. Electric operation with its superior advantages for frequent service over short distances has made suburban life possible.

In methods of artificial illumination the development of the electric light has spurred the homely fishtail gas burner to the undreamed glory of the inverted gas arc. Each has vied with the other to the rapid improvement of both. The tungsten incandescent lamp, however, has dealt gas a body blow, for it practically reduces the cost of electric light to less than one-half. Rarely even in this age does so radical an improvement as the tungsten lamp appear as suddenly.

And so I could go on enumerating the triumphs of scientific and technical knowledge — but why should I? We are so accustomed to them in these days that unless they are startling in their novelty we pass them over with hardly a thought. We accept them as a matter of course; we are glad to know they are here, but don' task us to understand them — they are scientific, they are mathematical, the working of them doesn't interest us in the least; let somebody else keep them going, and let us enjoy them. And this, ladies and gentlemen, brings me to the point I want to make, that practically every convenience and comfort that we enjoy requires for its manufacture and for its continued operation technically educated young men. That your electric light and telephone are not interrupted one scond; or that your street car, your bicycle, your automobile, or your airship, whichever be your means of locomotion, is ready when you are depends on the technical man. He is on the job from beginning to end; as inventor, as designer, as draughtsman, as inspector in manufacture, as salesman (it requires a technical education to sell most things nowadays),and more than all he is there to keep things going. The technical man is there all the time — you rarely hear of him, he isn't often in the newspapers, and he never gets thanked. In fact, you never think of him unless something goes wrong — then you jump on him. And I expect this is the reason that some people question the value of technical education. They

do not realize that we must have everywhere about us a body of highly trained men, ready in resource, quick in action, devoted to duty; planning and operating the facilities, comforts and pleasures of business and life.

Now if I had time I could tell you also how important technical and mathematical training is in business and other walks of life, how it makes a man accurate and observant, and how it gives him clear reasoning power — possibly you realize these things already. But do you know that they are so well recognized that many universities require a year's work in mathematics and physics even if the student is specializing in ancient languages or history and political economy? Therefore I say that Baltimore is to be congratulated that it has so excellent a technical school for its young men, offering them as it does opportunities which they might not otherwise have for obtaining professional training. It is fine to think of its going to its new home of enlarged facilities. For every man it graduates can benefit himself and his city by applying his training here in any one of many fields. If anyone should accuse me of prejudice or question the high value of the technical secondary school, let him note these facts which are really only the beginning of the story: I have asked the four large public service corporations in Baltimore to give me the number of their employees who are engaged in purely technical operations. I have asked them to exclude all classes of employees who are not entrusted with work requiring scientific and technical equipment, and to include only such men as engineers, draughtsmen, inspectors, and superintendents in responsible charge of work. I find that the Railway Company and the Lighting Company have each upward of one hundred and fifty men so engaged. The Telephone Company has between one hundred and fifty and two hundred; the Baltimore and Ohio Railroad Company has one hundred. Finally the city in all its departments has over five hundred and fifty men to whom it looks for solving the technical questions involved in its numerous works. Many of these men are brought to Baltimore from other cities, but there is no reason why each and every one of them should not be a graduate of the Polytechnic Institute. You will note that I have only mentioned five different corporations requiring such men and have made no mention of the vast number of manufacturing companies and individual firms, such as architects and engineers, all of whom have their own special requirements which can be filled only by men of scientific training. The city departments alone would require more than thirty graduating classes the size of this one to fill their needs.

You, young gentlemen of the graduating class, are about to enter this vast profession which builds and keeps in operation the complex mechanical structure of our daily life. You will go into its various branches as inclination indicates or opportunity offers. But into what-

ever particular line you go, two things which you will learn, among many others, occur to me: the first of these, which will be difficult in the learning, is that you must be content to do your very best without receiving any thanks. An engineer above all things must be accurate and go far beyond the surface demands of any problem put up to him, but, as I have already said, he will hear nothing from his work unless he makes mistakes. To be a successful engineer you must learn that your principal satisfaction will be in the fact that the work itself is properly done.

The second thing that you will learn is far more pleasant. It may not come to you for some time, but eventually you will realize that in a technical profession you have, besides a means of a livelihood, an ever-present interest and resource. You have never heard an engineer complain of being bored, and his pleasures are generally closely allied with his work.

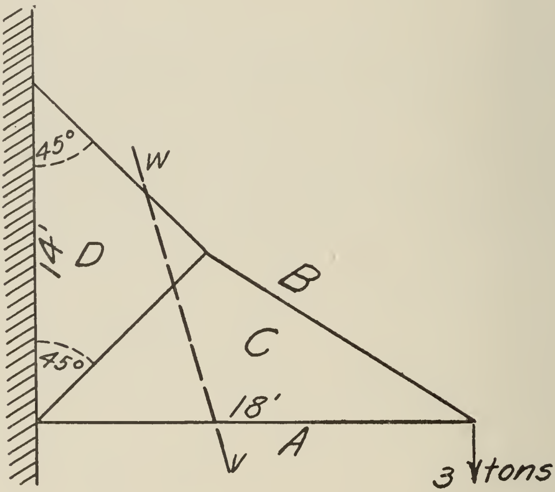
You have now taken only the first step, and the next few will be full of hard falls for you. The first five years of your professional life will be full of discouragements. You will feel that nobody gives you proper recognition either by money return or by commendation of work, but if you stick to the work you will eventually come into the realization that you have entered one of the most important professions of the world's work, and one which yields a direct evidence of all work well done, greater than in any of the others, and so I wish you good luck.

SOME RECENT EXAMINATION PAPERS.

GRAPHIC STATICS.

FOURTH YEAR CLASS — MAY 20, 1908.

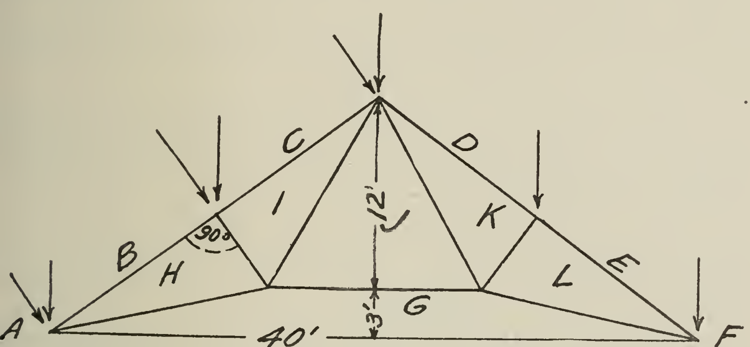
1. The framed cantilever of the figure supports a vertical load of 3 tons at its extremity. Find the stress in each member by means of the reciprocal diagram, and determine graphically the horizontal and vertical components of the wall reactions. Find by the method of sections the stresses in the members cut by *vw*.



2. A cantilever, 14 feet long, is loaded uniformly with 30 lbs. per foot, and has in addition a concentrated load of 150 lbs. at its extremity and one of 200 lbs. at 9 feet from the wall. Construct the bending-moment and shear diagrams. Scales: Linear, ¼ inch = 1 ft.; load, 1 inch = 400 lbs.

3. A uniform beam of 40 feet span and supported at the ends, is loaded uniformly for a distance of 25 feet from the left support with 1.2 tons per foot, including the weight of the beam. Draw the bending-moment and shear diagrams, and measure the bending-moments at each of the following named sections: At the middle of the beam; at the middle of the load; at the end of the load; at the dangerous section. Scales: Linear, 0.1 inch = 1 foot; 1/20 inch = 1 ton.

4. The roof truss of the figure supports a uniformly distributed dead load of 2 tons, and is designed to be subjected also to a normal wind pressure of 19.2 lbs. per square foot. The distance between the principals is 14 feet. Assuming the wind to blow from the left side, and that the left end of the truss is fixed and the right end free to move on expansion rollers, it is required to determine from the reciprocal diagram the nature and magnitude of the stress in each member. Scales: Linear, ⅛ inch = 1 foot; load, 1 inch = 1 ton.



MECHANICS OF MATERIALS.

FOURTH YEAR CLASS — MAY, 1909.

1. A 12-inch Cambria I-beam weighing 40 pounds per foot and 20 feet long is supported at two points 12 feet apart. The left end projects 5 feet over the left support. In addition to its weight the beam supports concentrated loads of 100 pounds at the extreme left end and 300 pounds at 4 feet to the right of the left support. Plot the shear diagram. Linear scale 3/16 inch = 1 foot, and load scale, 1 inch = 500 pounds. What is the maximum value of the shear and where does it occur? What is the maximum value of the bending-moment and where does it occur? Is the beam safe? Why?

2. Find the moment of inertia and radius of gyration of a triangle about an axis through the centre of gravity and parallel to the base. Using the value just found, determine the moment of inertia about a parallel axis through the apex.

3. What uniform load may be placed upon a wooden cantilever 5 feet long, 3 inches wide, and 5 inches deep, to produce a working stress of 900 pounds per square inch?

4. What safe load may be carried by a 12-inch Cambria I-beam weighing 40 pounds per foot and 15 feet long when used as a column with fixed ends in a building?

5. What diameter of cold rolled steel shafting would you select to transmit 10 H.P. at 250 r.p.m.?

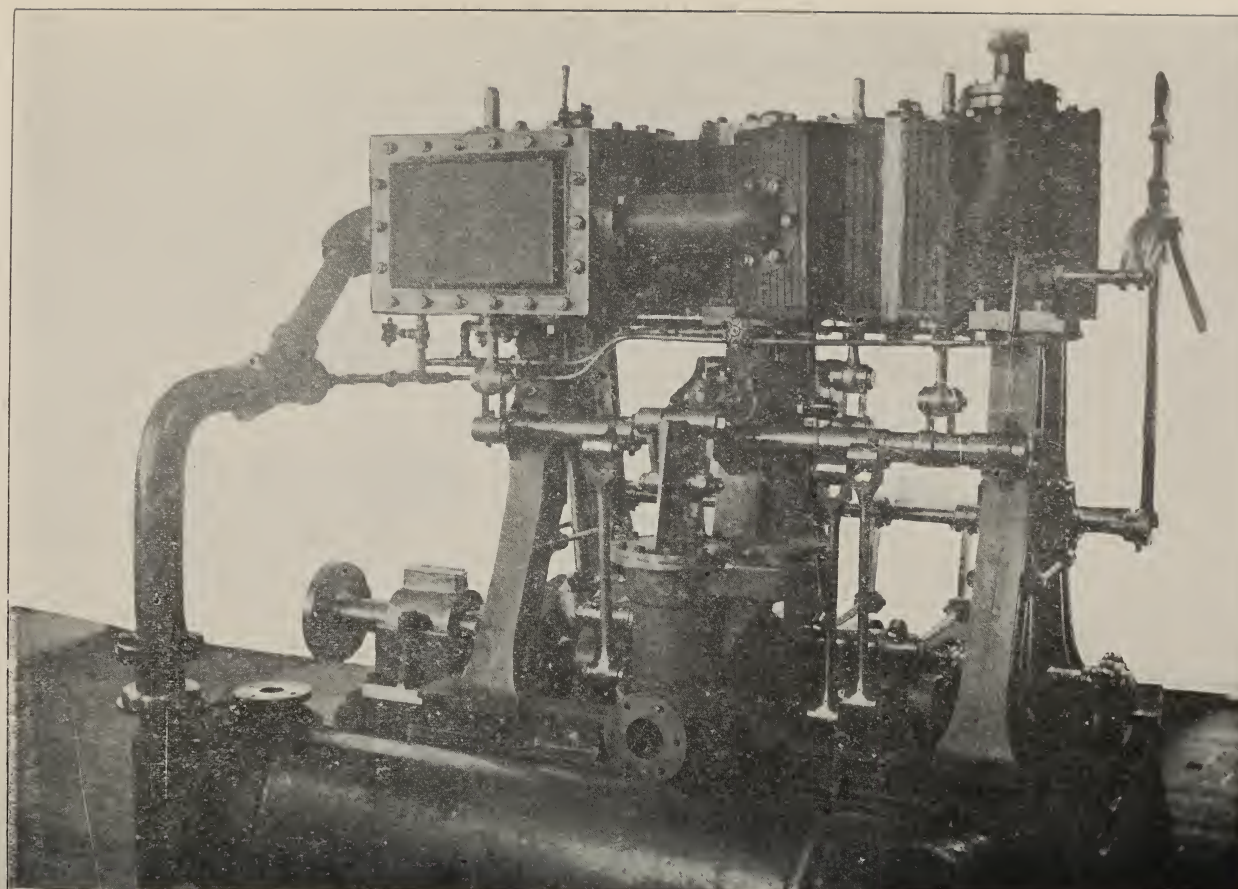
6. Show that the maximum deflection of a simple beam loaded with W pounds uniformly distributed is $\frac{5WL^3}{384EI}$. What will be the maximum deflection due to its own weight of a 3-inch Cambria I-beam weighing 5.5 pounds per foot and 20 feet long? Assume the coefficient of elasticity to be 29,000,000 lbs. per square inch.

STEAM AND INTERNAL COMBUSTION ENGINES.

FOURTH YEAR CLASS — MAY, 1909.

(Questions 1 to 9 inclusive for First Section; Questions 3 to 11 inclusive for Second Section.)

1. Show with the aid of sketches the operation of the four-stroke cycle.



TRIPLE EXPANSION ENGINE.

2. Sketch and describe the Keerting suction producer plant.

3. Draw indicator cards showing the effect of governing by: (a) Delayed ignition; (b) premature ignition; (c) throttling the normal charge; (d) cutting off.

4. What principles were laid down by the inventor in the design of the Diesel engine? Sketch and describe the device for suppyling fuel to the cylinder.

5. The following data were taken from a test of natural gas made with a Junker calorimeter: Amount of water, 0.3689 cu.ft.; differences in meter readings, 1 cu.ft.; temperature of room, 72.73° F.; temperature of inlet water, 53.42°; temperature of outlet water, 94.3°; temperature of gas at meter, 71.22°; temperature of gas in chimney, 60.33°; pressure of gas, 0.2 inch of water; barometer reading, 14.49 lbs. per sq. inch. Find: (a) B. T. U. per cubic foot of gas at conditions of test; (b) B. T. U. per cubic foot of gas under standard conditions.

6. Sketch and describe a gasolene vaporizer.

7. Sketch and describe the Hornsby-Akroyd oil engine.

8. The following data were taken from a test of a Diesel engine using kerosene: Diameter of cylinder, 15.75 inches; stroke, 23.65 inches; r.p.m., 158.8; M. E. P. from diagram, 92.252 lbs. per sq. inch; B. T. U. per lb. of fuel, 18,610; fuel consumption per hour, 29.84 lbs.; length of Prony brake arm, 60 inches; pressure on scales, 460.4 lbs Find: (a) I. H. P.; (b) B. H. P.; (c) mechanical efficiency; (d) thermal efficiency based on B. H. P.

9. Name four faults which produce in each case: Weak explosions; misfire; premature ignition. Name two faults which cause smoky exhause.

10. A 16″x20″ engine uses steam at 120.3 lbs. gage pressure. Back pressure, 3 lbs. absolute; r.p.m., 165; cut-off, 0.25 stroke; clearance, 4%; dryness fraction of the steam, 0.98; thermal value of the fuel, 14,300 B. T. U.; temperature of the steam, 350°; temperature of feed water, 132°; boiler efficiency, 70%. The specific volume of the working steam is 3.329 cubic feet. Using a mean pressure factor of 0.9, find: (a) Pounds of steam per I. H. P. per hour; (b) pounds of water evaporated per pound of coal; (c) pounds of coal per I. H. P. per hour.

11. Show that the weight of the reciprocating parts of a simple duplex egnine is greater than that of a compound engine of the same power, the two types having in common: Initial steam pressure, 115 lbs. absolute; exhaust pressure, 2 lbs. absolute; ratio of expansion, 8. For the compound engine the receiver pressure is 28 lbs. absolute, and the ratio of the cylinders is 4.

MECHANICS.

FOURTH YEAR CLASS — January, 1910.

1. A body starts from rest and moves with a constant acceleration. If it passes over 35 ft. during the fourth second from rest, what is its acceleration?

2. Part of a machine is moving southeast at 10 feet per second and after one-half second it is moving east at 4 feet per second. What is the amount and direction of the average acceleration during the one-half seconds? If the mass of the part is one ton, what was the magnitude of the average force acting on it?

3. A 20 ton car accelerates from 10 to 20 miles an hour in 15 seconds down an incline of 1 in 100 against a uniform frictional resistance of 25 lbs. per ton. The motors exert a uniform tractive effort during the 15 seconds. Find: The accelerating force; the uniform pull of the motors; the horsepower developed by the motors at the beginning of the period; the space passed through.

4. With the same conditions as given in problem 3, find the increase in kinetic energy and the decrease in potential energy of the car, the work done in overcoming the frictional resistance, and the work done by the motors. Write the equation of energy containing these four quantities.

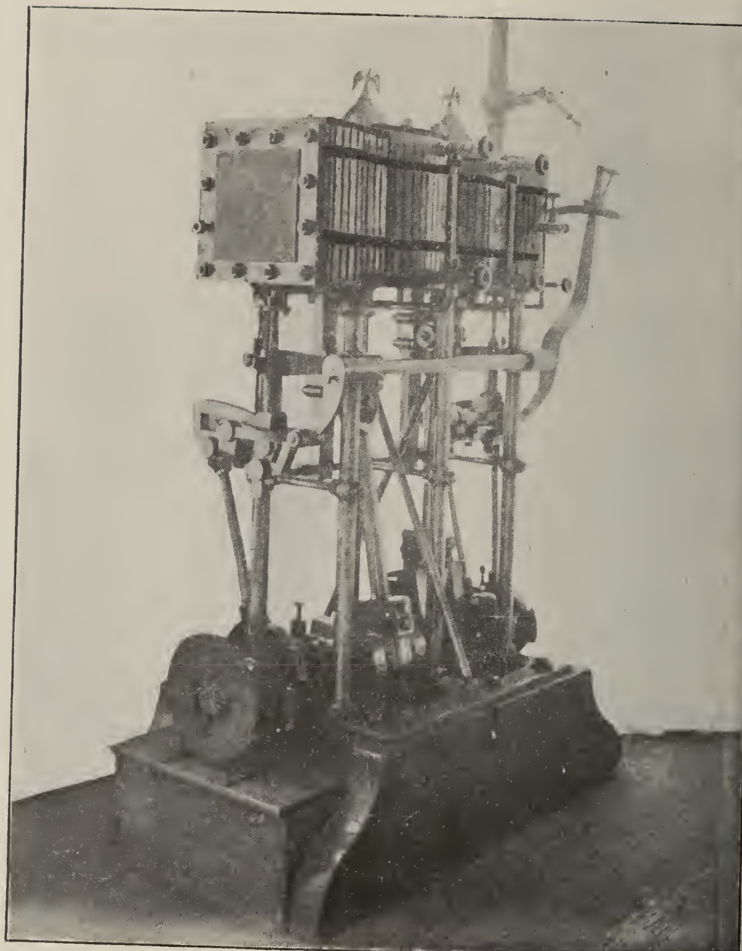
5. A 20-ton car is rounding a curve of 1000 feet radius at 40 miles per hour. What is the magnitude and direction of its acceleration? How large a force is necessary to give the car this acceleration?

6. A 10 lb. weight is prevented from sliding down a rough inclined plane by a horizontal force of 5 pounds. If the inclination of the plane is 30°, what is the value of the coefficient of friction called into play?

7. A crane has a vertical post 9 feet high and a boom 18 feet long weighing 0.5 ton. The angle between the boom and post is 45° and a weight of 5 tons is suspended from the end of the boom. Find the tension of the tie joining the end of the boom and the top of the post, and the magnitude and direction of the thrust on the lower end of the boom.

8. Find by construction and by calculation the distance from the bottom edge to the centre of gravity of an unequally flanged beam section of the following dimensions: Top flange, 3 inches wide and 1.5 inches thick; bottom flange, 15 inches wide and 1.75 inches thick; webb, 1.5 inches thick; total height, 18 inches.

9. Determine the width of single-ply leather belting required to transmit 40 H. P. from a pulley 4 feet in diameter making 375 r.p.m. Assume: Arc of contact, 172.4°; coefficient of friction, 0.3; density of leather, 0.036 lbs. per cubic inch; thickness of belt, 7/32 inch; working stress, 66 pounds per inch width of belt. Take into consideration centrifugal force and the thickness of the belt.



COMPOUND ENGINE,

BUILT BY STUDENTS AFTER DESIGN OF THE BUREAU OF STEAM ENGINEERING, NAVY DEPARTMENT.

MECHANICAL LABORATORY PRACTICE.

FOURTH YEAR CLASS — MAY, 1909.

1. In what two ways does carbon combine with iron to form cast iron? How are cast irons graded? What is the effect of manganese on cast iron?

2. Describe the process of making crucible steel; bessemer steel; open hearth steel. What is semi-steel?

3. Name the type of governor on the high speed engine in the laboratory and dscribe its action. How may the steam consumption of an engine be found other than by the indicator?

4. Explain fully with the aid of a sketch how to find the indicated steam consumption of a compound engine from the high pressure cylinder diagram.

5. Describe the throttling calorimeter and give the theory of its action. How would very wet steam be indicated? How would superheated steam be shown and how may the number of degrees of superheat be found?

DIFFERENTIAL CALCULUS.

FOURTH YEAR CLASS — JUNE 1909.

1. Define increment and derivative. Illustrate by finding the derivative of the function $y = \sqrt{a^2 - x^2}$.

2. Find $\dfrac{dy}{dx}$ when $x = a \log \dfrac{y + \sqrt{y + a}}{\sqrt{a}}$

3. What is the area of an equilateral triangle at the moment its side is increasing at the rate of 10 feet per minute and its area at the rate of 10 square feet per second?

4. Find $\dfrac{dy}{dx}$ from $y = (x^2 + 1)\sqrt{x^3 - x}$.

5. Find $\dfrac{dy}{d\theta}$ from $y = \log \dfrac{\sin \frac{1}{2}(\theta - a)}{\sin \frac{1}{2}(\theta + a)}$.

6. Find $\dfrac{d^3y}{dx^3}$ from $y = (\sin x - \cos x)xe^x + 3e^x\cos x$.

7. Determine the limiting value of $\dfrac{\log (x^2 - 4x + 5)}{\log \cos (x - 2)}$ when $x = 2$.

8 Find the tangent of 44°, using Taylor's Theorem.

9. A weight of 1,000 pounds hanging two feet from the fulcrum end of a lever is to be raised by an upward force at the other end. Supposing the lever to weigh 10 pounds per foot, find its length that the force may be a minimum.

10. Find the equations of the two tangents to the circle $x^2 + y^2 - 3y = 14$, parallel to the line $7y = 4x + 6$.

11. Change the independent variable from x to z in the following: $\dfrac{d^2y}{dx^2} + \dfrac{1}{x} \cdot \dfrac{dy}{dx} + y = 0$, when $x^2 = 4z$.

Omit any one except 4 or 9.

INTEGRAL CALCULUS.

FOURTH YEAR CLASS — MAY, 1909.

1. Find the equations of the asymptotes of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$.

2. If the coordinates of the centre of curvature of the equilateral hyperbola $2\,xy = a^2$ have the relations $A + B = \frac{(y + x)^3}{a^2}$ and $A - B = \frac{(y - x)^3}{a^2}$, prove that the equation of the evolute is $(A + B)^{2/3} - (A - B)^{2/3} = 2a^{2/3}$.

3. $\int \frac{x + 3}{\sqrt{x^2 + 4}}\,dx = ?$

4. The slope of the tangent to a curve at any point is $-\frac{4x}{9y}$, and the curve passes through the point (3, 2). Find the equation.

5. $\int \frac{x\,dx}{(x + 1)\,(x + 3)\,(x + 5)} = ?$

6. $\int \frac{dx}{x + \sqrt{2x - 1}} = ?$

7. $\int \frac{\tan^7 x + 1}{\tan x + 1}\,dx = ?$

8. $\int x^2 \tan^{-1} x\,dx = ?$

9. Find the entire area of the curve $\rho^2 = a^2 \cos 2\theta$. Plot the curve.

10. Find the volume generated by turning about the X—axis the portions of the curve $x^2 - 3x + 2y = 0$ which is above the X—axis.

TRIGONOMETRY.

SECOND YEAR CLASS — JUNE, 1909.

1. (a) On the circumference of a circle of 50 feet radius an arc of 10 feet is laid off. How many degrees in the angle at the centre subtended by this arc? (b) Given cos 2A = sin A, find the number of degrees in the angle A.

2. Find the value of the six functions of 60°.

3. Given tan A = 3, find the other functions of the Angle A.

4. Solve the equation $\sin^2 x - \cos x = \frac{1}{4}$.

5. From a tower 58 feet high the angles of depression of two objects situated in the same horizontal line with the base of the tower, and on the same side, are 30° 13′ 18″ and 45° 46″ 14″. Find the distance between these objects.

ANALYTIC GEOMETRY.

THIRD YEAR CLASS — JUNE 1909.

1. Find the equation of the ellipse, having given the foci and the constant sum 2a.

2. The equation of an ellipse is $25x^2 + 81y^2 = 450x$ when referred to rectangular axes. Find the major and minor axes and the coordinates of the centre.

3. Tangents are drawn from (3, 2) to the ellipse $x^2 + 4y^2 = 4$. Find the equation of the chord of contact, and of the line that joins (3, 2) to the mid-point of the chord.

4. Find the equations of the tangent and the normal to the hyperbola at the point (x_1, y_1) on the curve.

5. Write the equation of the hyperbola conjugate to $9x^2 - 16y^2 = 144$, and find its axes, distance between its foci, and its latus rectum.

6. Find the length of the semi-diameter conjugate to the diameter $y = 3x$ in the hyperbola $9x^2 - 4y^2 = 36$.

7. Define the Conchoid of Nicomedes. Develop its equation and discuss it.

8. Plot the curve whose equation is $r = a(1 - \cos \theta)$.

SURVEYING.

THIRD YEAR — JUNE 12, 1908.

1. Show, by drawing, a vernier reading 7.563.

2. From the following field notes, plot the field and calculate its area:

1.	N. 73° 30′ W.	5.00	chains.
2.	S. 16° 30′ W.	5.00	chains.
3.	N. 28° 30′ W.	7.07	chains.
4.	N. 20° 00′ E.	11.18	chains.
5.	S. 43° 30′ E.	5.00	chains.
6.	S. 13° 30′ E.	10.00	chains.

3. In the triangle ABC, AB = 12 chains, AC = 10 chains, and BC = 8 chains; part off a trapezoid of 1 acre 96 perches by the line DE parallel to AB.

4. Write the proper numbers in the third and fifth columns in this scheme, make a profile of the section, and determine the gradient per station:

Station	+ S	H. I.	— S	H. S.	Remarks
					Bench on post
0			7.4		22 feet north
			3.9		of 0.
2			5.6		
			4.6		
t. p.	3.855		5.513		
			4.9		
5			3.5		
			1.2		

ALGEBRA.

SECOND YEAR CLASS — JUNE, 1909.

1. In how many different ways can $1.65 be paid in quarter dollars and dimes?

2. Expand $\dfrac{1}{(a - 2b^2)}$ to four terms by the Binomial Theorem and simplify the result.

3. Write the sixth term of $(27x^3 - 8y^3)^{\frac{1}{3}}$.

4. Find l and n in the arithmetical progression in which $a = 7$, $d = 2$, and $S = 1927$.

5. The sum of three terms in geometric progression is 63 and the third is 45 greater than the first. What are the terms?

6. Find by logarithms the value of $\dfrac{4.5921 \sqrt[3]{0.021946}}{(0.41587)^3}$.

7. Solve $0.98765^x = 2.47$.

8. Find the diameter of a spherical shell whose thickness is 2 inches, and whose weight is $^{19}/_{27}$ of what it would be if it were solid.

GEOMETRY.

SECOND YEAR CLASS — JUNE, 1909.

1. Prove that the volume of a triangular pyramid is equal to one-third of the product of its base by its altitude.

2. Prove that the volume of two triangular pyramids, having a trihedral angle of the one equal to a trihedral angle of the other, are to each other as the products of the three edges of these trihedral angles.

3. Prove that every section of a circular cone made by a plane parallel to the base is a circle.

4. Find the diameter of a given material sphere.

5. Find the radius of a circle determined by a plane one inch from the centre of a sphere 5 inches in diameter.

ELECTRICITY.

FOURTH YEAR CLASS — February 5, 1909.

1. A four-pole dynamo is designed to give 110 volts and 50 amperes. The field strength is 3,500,000 lines per pole and the speed 900 revolutions per minute. What is the number of conductors on the armature? What would be the voltage if altered to a two-circuit machine? If the field loss is 3 per cent of the output, the stray-power loss 500 watts, and the armature resistance 0.5 ohm, what power would be required to drive the machine?

2. How would a disconnected coil on the armature of a dynamo be indicated if such disconnection should occur while the machine was in operation? What would be the indications of a short-circuited armature coil? If a machine designed for 125 volts gave only 8 volts at normal speed, what is probably the defect?

3. The armature of a motor has a resistance of 10 ohms and an ammeter connected in the armature circuit indicates 12 amperes when the motor is running with full load on 220 volts. What is the counter electromotive force? What is the output of the motor in kilowatts? If the current through the fields were reduced, how would the motor be affected?

4. Sketch the mechanism of a series arc lamp. Why is the enclosed arc lamp preferred to the open arc? What is the chief advantage and disadvantage of the flaming arc lamp? Why is the tungsten lamp so efficient?

5. A circuit consists of 300 lamps, 40 watts each, the distance to the lamp center being 120 feet, and the voltage at the lamps 104. What size wire, B. & S. gauge, should be used as a main? Calculate, by heat formula, the size required for interior work for the above current. Which size should be used in the installation?

ELECTRICITY.

FOURTH YEAR CLASS — May 21, 1909.

1. Calculate the average drop on a trolley line 4 miles long, supplying current to 10 cars requiring 60 amperes each, if the feeders are 4 wires arranged in parallel, each wire No. 0000. What would be the respective drops if the line were divided into 2 sections, and 2 of the above wires were made to act as feeders for one section and the remaining 2 for the other section?

2. A 10 K. W. transformer, operated on a 1500 volt primary, is found to consume 160 watts when secondary is open. The secondary voltage is 100, the resistance of the primary 1.9 ohms, and the resistance of the secondary 0.009 ohm. What will be its efficiencies at one-half load, full load, and one-half overload respectively?

3. A single-phase alternator has 36 poles, with a flux of 800,000 line per pole. Each armature pole has 25 turns of wire. What will be the electromotive force and frequency when run at a speed of 300 revolutions per minute? What will be the horse-power delivered by this machine when supplying 47 amperes to a load whose power-factor is 80 per cent?

4. A three-phase, Y connected alternator generates 1200 volts and 20 amperes per armature circuit. What are the line voltage and amperage? What would be the line voltage and amperage if the machine were delta connected? If the efficiency were 92 per cent, what horse-power would be required to drive it?

5. A three-phase circuit indicates 2,000 volts and 75 amperes when the power-factor of the load is 85 per cent. What horse-power is being delivered? Show by diagram how transformers should be connected in a three-phase line for lighting and power service respectively. A three-phase motor receives 40 amperes at 220 volts and the losses in the motor are 1,200 watts. What is the power-factor if the motor is delivering 8 horse-power?

CHEMISTRY AND PHYSICS.

FOURTH YEAR CLASS, MAY 25, 1909.

1. Give a summary of the members of the chlorine family.

2. Discuss phosphorus.

3. How may temporary hardness in water be removed? How may permanent hardness be counteracted? Give reactions for both cases.

4. Discuss copper.

5. Illustrate an homologous series of carbon compounds.

6. What changes take place when sugar is subjected to yeast fermentation.

7. Calculate the weight of quicklime a manufacturer might expect from 1,000 kilograms of pure limestone. What weight of carbon dioxide

would be given off? What would be the volume of the gas if the temperature were 20°C. and the barometer reading 700 mm.?

8. Describe and explain the method of finding the thickness and refractive index of a thin plate of glass by means of the microscope.

9. Explain how to combine prisms so as to produce: (a) Deviation without dispersion; (b) Dispersion without deviation.

10. An object is placed 28 cm. from a concave mirror whose focal length is 10 cm. Locate the image. Is it real or virtual?

ANALYTIC CHEMISTRY.

FOURTH YEAR CLASS MAY 25, 1909.

1. Calculate the respective weights to make 2 liters of a normal solution of each of the following substances: H_2SO_4, 96%; HCl, 80%; HNO_3, 60%; NH_4HO, 45%; H_3PO_4, 60%.

2. What weight of $KMnO_4$ will be required for 5 liters of a standard solution that will convert iron at the rate of 0.002 g. per cc.? Complete the equation $2\ KMnO_4 + 10\ FeSO_4 + 8\ H_2SO_4 =$

3. A solution is to be tested for NH_3. The gas formed from 60 cc. of the solution is passed into 50 cc. of normal acid and the acid is neutralized with 36 cc. of normal KOH. What weight of NH_3 per liter is indicated? What volume of normal HCl can be made from 3 liters of dilute acid that requires 62.4 cc. of normal alkali solution to neutralize 38 cc. of it?

4. A sample of iron is tested for phosphorus by dissolving 5 g. of it and converting to ammonium phospho-molybdate $(NH_4)_3(MoO_3)_{11}PO_4 + 9H_2O$. The precipitate weighs 0.61 g. What per cent of phosphorus is indicated? What weight of the sample should have been used if the weight of the precipitate is to indicate per cent of phosphorus without calculation?

5. How many cc. of a solution of $CdCl_2$, made by dissolving 40 g. of the pure salt in water and diluting to 1 liter, will be required to absorb the sulphur from 6 g. of a sample of iron containing 0.5 per cent of sulphur? How many cc. of an iodine solution, containing 4.5 g. to the liter, will be required to titrate it?

Combining weights required: P, 31; Fe, 56; Mn, 55; Mo, 96; K, 39; Cl, 35.4; Cd, 112; I, 127; S, 32.

ENGLISH.

THIRD YEAR CLASS — JUNE 10, 1909.

Write on five of these subjects, viz.: 2; 4; 7; 1 or 3; and 5 or 6.

1. Milton's Puritanism.

2. What "Comus" is.

3. Some characteristics of Milton's style.

4. The essentials of a good argument.

5. A summary of Burke's objections to Lord North's bill.

6. The Polytechnic should close at noon on Wednesdays and Saturdays, instead of all day on Saturdays.

7. The formation of the English Language.

ENGLISH.

SECOND YEAR CLASS — JUNE 8, 1909.

1. Give, in the form of a connected theme, the following information about the "Spectator": (a) its origin; (b) its contributors; (c) its character; (d) its purpose.

2. Discuss the stories that make up "The Merchant of Venice," explaining how they are worked into each other to make one story.

3. Write on the following subjects:
(a) Shylock was more sinned against than sinning. (Take the affirmative or negative, construct a brief, and write the argument.
(b) The place of Act V in "The Merchant of Venice."
(c) One of the following: (1) My visit to Buffalo Bill's show. (2) An exciting baseball game. (3) My plans for the summer. (4) Along the waterfront of Baltimore. (5) My holiday.
(d) One of the following: (1) Sir Roger's visit to the Polytechnic Institute; (2) Sir Roger's butler in Lexington Market; (3) the "Spectator" at Oriole Park.

4. Name the different types of discourse, state the purpose of each, and mention at least two of the most important rhetorical principles that apply to each.

FRENCH.

FOURTH YEAR CLASS — MAY, 1909.

1. Translate the following extract from Hurdler's Scientific Reader:

La transformation de l'énergie thermique ou chaleur en énergie électrique constitue un problème séduisant en théorie, non résolu encore en pratique. Il semble, en effet, tout à fait illogique, au premier abord, de bruler du charbon sous une chaudière ou du gaz dans un moteur, d'utiliser cette vapeur ou ce gaz à la production d'un travail mécanique et de transformer ce travail mécanique en énergie électrique. Ne serait-il pas plus simple et plus économique de bruler ce charbon ou ce gaz dans un générateur approprié, une *pile thermo-électrique,* et d'en obtenir directement l'énergie électrique? Dans l'état actuel de nos connaissances, l'expérience répond catégoriquement: *Non.* C'est au travail mécanique que l'on s'adresse aujourd'hui presque exclusivement pour la production industrielle de l'énergie électrique.

Nous n'entreprendous pas ici la description des générateurs mécaniques, d'énergie électrique qui demanderait, à elle seule, un gros volume; nous nous contenterons de dire que tous ces générateurs sans exception sont fondés sur le principe de l'induction découvert par Faraday en 1830. L'induction se produit lorsq'il y a déplacement relatif du champ magnétique produit par un aimant ou un électroaimant, et d'une ou plusieurs bobines de fil de cuivre placées dans ce champ. Le système produisant le champ magnétique porte le nom *d'inducteur,* le circuit dans lequel naissent les courants constitue *l'induit.* Tous les générateurs mécaniques d'énergie électrique ont donc pour objet de produire le déplacement relatif de l'inducteur et de l'induit.

La plus grande partie du travail mécanique depensé pour produire ce déplacement se retrouve dans le circuit électrique sous forme d'énergie électrique; le générateur est d'autant plus parfait que cette fraction, qui constitue le *rendement,* est plus grande.

Les progrès accomplis depuis une quinzaine d'années sont, à ce point de vue, des plus remarquables; le rendement des générateurs électriques actuels dépasse souvent 95%. Il est bien supérieur à celui de la machine à vapeur qui ne rend, sur l'arbre, et pour les moteurs les plus perfectionnés, que moins de 90% de la puissance indiquée fournie par la vapeur sur les pistons.

La puissance des générateurs d'énergie électrique fort improprement appelés *dynamos* est, en quelque sorte, illimitée. Elle s'accroit chaque jour pour répondre à de nouveaux besoins, sans que cependant l'on éprouve la nécessité d'augmenter indéfiniment cette puissance. Dans bien des cas, en effet, il est préférable d'employer deux ou plusieurs machines travaillant parallèlement et mises successivement en marche ou arrêtées suivant les besoins.

2. Translate the following extract from Super's Reader:

La personne qui m'a raconté cette anecdote, passant quelques mois après à Jegorievski, pendant la nuit, devant une petite maison de bonne apparence et fort éclairée, descendit de son carrosse, et s'approcha d'une fenêtre pour jouir du spectacle d'un bal très animé qui se donnait au rez-de-chausée. Un jeune sous-officier regardait aussi très attentivement ce qui se passait dans l'intérieur de l'appartement. "Qui donne le bal?" lui demanda le voyageur.

"C'est monsieur le major qui se marie."

"Et comment s'appelle monsieur le major?"

"Il s'appelle Kascambo." Le voyageur, qui connaissait l'histoire singulière de cet officier, se félicita d'avoir cédé à sa curiosité, et se fit montrer le nouveau marié, qui, rayonnant de plaisir, oubliait dans ce moment les Tchetchenges et leur cruauté. "Montrez-moi, de gràce," ajouta-t-il encore, 'le brave denchik qui l'a délivré." Le sous-officier, après avoir hésité quelque temps, lui répondit: "C'est moi." Doublement surpris de la rencontre, et plus encore de le trouver si jeune, le voyageur lui demanda son âge. Il n'avait pas encore achevé so vingtième année, et venait de recevoir une gratification avec le grade de sous-officier, en récompense de son courage et de sa fidélité. Ce brave jeune homme, aprèes avoir partagé volontairement les infortunes de son maître, et lui avoir rendu la vie et la libertié, jouissait maintenant de son bonheur en regardant sa noce à travers les vitres. Mais comme l'étranger lui témoignait son étonnement de ce qu'il n'était pas de le fête, en chargeant à ce sujet son ancien maître d'ingratitude, Ivan lui lança un regard de travers, et rentra dans la maison en sifflant l'air, *Hai luli, hai luli.* Il parut bientôt après dans la salle du bal, et le curieux remonta dans son carrosse enchanté de n'avoir pas reçu un coup de hache sur la tête.

3. Select five verbs from the extract of Question 1; locate them, give their principal parts, and write in full the tense in which they occur.

4. Point out, in either or both of the extracts of Questions 1 and 2, three constructions or idioms peculiar to French, and explain their peculiarity.

HISTORY AND CIVICS.

SECOND YEAR CLASS — JUNE, 1909.

Answer any five questions.

1. (a) Write a sketch of each of the following, mentioning public offices held, political principles, personal character, and influence on public affairs: (1) Henry Clay; (2) Abraham Lincoln; (3) Jefferson Davis.

(b) Define the following terms: Writ of habeas corpus, ex post facto law, paper blockade, original and appellate jurisdiction, copperhead.

2. (a) What is international law and how does it come to be recognized?
(b) Mention several cases in American history where disputes have arisen concerning international law.
(c) How is a treaty made with the United States?
(d) Mention four important treaties negotiated by the United States.

3. (a) Write a brief account of the Federal judiciary, telling of (1) its organization, (2) its independence, (3) the matters in which it has jurisdiction.
(b) Name four important decisions of the Federal Supreme Court, and tell the influence of each.

4. (a) How may the Federal Constitution be amended?
(b) Give an account of the amendments that have been made, stating their provisions and the circumstances connected with their adoption.

5. (a) Write a brief account of (1) the Whig Party, (2) the Democratic Party from 1828 to 1861, and (3) the Republican Party to 1861.
(b) In what three ways, in the course of our history, have party candidates for the presidency been named?

6. (a) State fully the constitutional powers of Congress over foreign commerce.
(b) Mention three examples of legislation in which these powers were exercised; stating in each case the time, provisions, and purpose of the act. (The acts chosen must represent three different kinds of legislation).

SPECIMEN ENTRANCE EXAMINATION PAPERS.

Set for Pupils Other Than Those Promoted from the Grammar Schools.

SPELLING AND PENMANSHIP.

Writing from dictation a paragraph or two of some standard text — Irving's Rip Van Winkle or Bancroft's United States History.

GRAMMAR.

I.—Use each part of speech in a different sentence, indicating the part of speech used in each sentence by underscoring and naming it.

II.—Define and give an example of a simple sentence, of a complex sentence, and of a compound sentence.

III.—Parse the italicised words in the following sentence: "By not heeding the *counsels* of our elders, *how* often do we *lose what* we should gain!"

IV.—Analyze the following sentence: "If we send the sailors a message in time, they will help us when the savages attack us."

V.—Write sentences illustrating the correct use of any perfest tense of each of the following verbs: sit, set, seat, lie, lay, write, go.

COMPOSITION.

The subject set is a description of some well-known place or object, or an account of some historical event.

UNITED STATES HISTORY.

1. What country was each of the following explorers serving when he came to America, and what territory did he discover or explore: Columbus, De Soto, Drake, Cartier?

2. Locate the settlements of the French, the Spanish, the Dutch.

3. Give a brief account of the settlement of Maryland.

4. Give a brief account of the wars between the English and French, extending from 1689 to 1763. State causes and results.

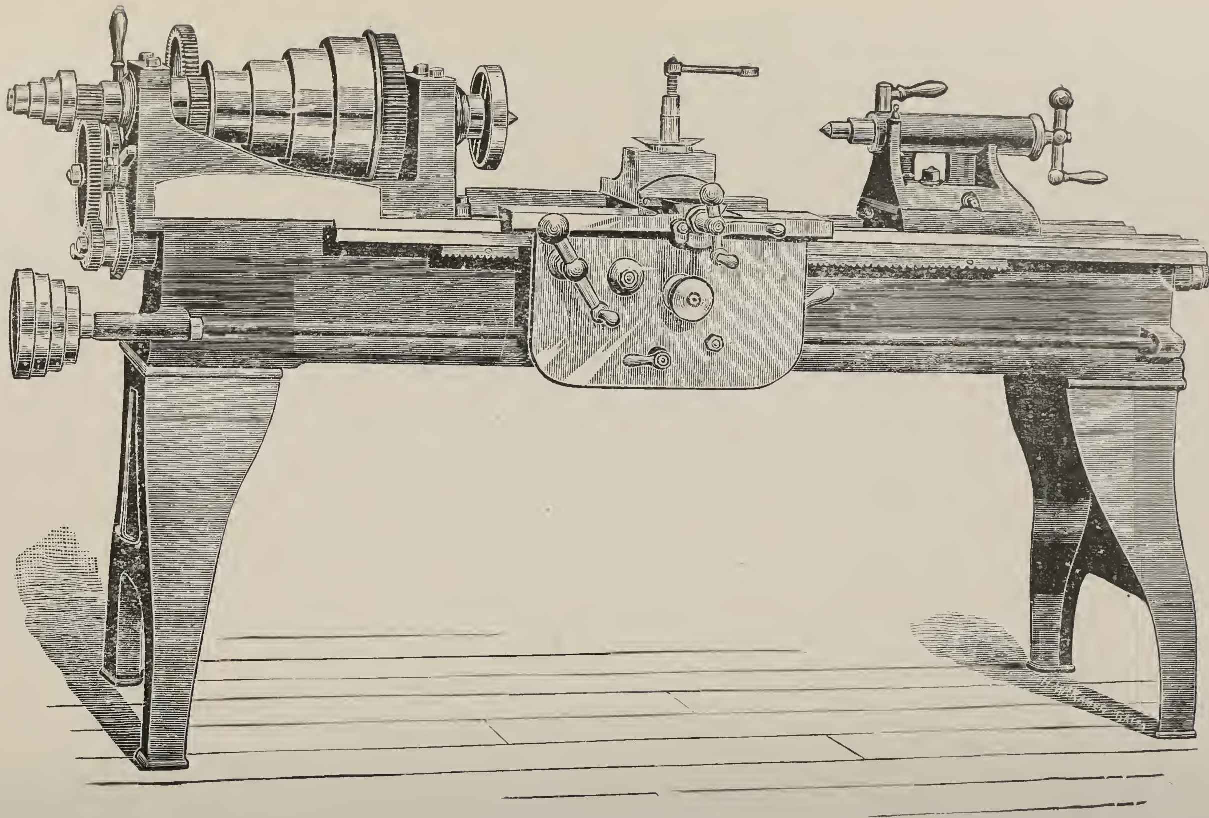
5. (a) State several causes of the Revolutionary War. (b) Name four important battles of the Revolution, and give a brief account of each.

6. What were the "Articles of Confederation," and why, and by what, were they superseded?

7. What is meant by "The Missouri Compromise?"

8. Name the principal causes of the Civil War. Who commanded on each side at Gettysburg? Why was the battle of Gettysburg so important?

9. What reason did the United States assign for going to war with Spain in 1898? What territory did the United States acquire as a result of that war?



BUILT BY STUDENTS.

ARITHMETIC.

1. Divide 5.375 by 0.0125, obtaining the exact result.

2. Simplify $\frac{1 + 0.5}{1 - 0.5} \times \frac{0.05 \div 0.005}{0.005 \div 0.05} \div \frac{0.4\frac{1}{2}}{0.22\frac{2}{9}}$

3. A merchant's sales on Monday amounted to $385.84. His sales on Monday were 16 2/3% of 54% less than the amount of goods sold on Tuesday. What was the amount of Tuesday's sales?

4. A firm sold an engine for $7,050, thereby losing 6%; for what should it have been sold in order to gain 12%?

ALGEBRA.

1. Factor the expressions: $a^2 + 6ax + 5x^2$, $n^{10} - 16n^5 - 80$, and $1 - 9x - 36x^2$.

2. Simplify $\left[(a^2-x^2) \div (\frac{1}{x} - \frac{1}{a})\right] - \left[(a^2-x^2) \div (\frac{1}{x} + \frac{1}{a})\right]$.

3. Given $\frac{2x+1}{5} - \frac{3y+2}{7} = 2y - x$, $\frac{3x-1}{4} + \frac{7y+2}{6} = 2x - y$, find the values of x and y.

CATALOGUE OF STUDENTS.

Students whose names are marked with an asterisk (*) received 85% or more of the possible multiple for the year.

CLASS OF 1910 — 78 MEMBERS.

Laurence Albaugh,
*Robert E. F. Aler,
*William H. Barnard, Jr.,
Ralph G. Biddle,
Leo Blankman,
*Jacob Blaustein,
Howard F. Carr,
Laurence B. Chenoweth,
Lester M. Cummings,
*Herbert A. Ehrman,
Ernest W. Eickelberg,
Franklin C. Eleder,
George B. Farlow,
George E. Finck,
Leon W. Frederick,
Charles V. French,
G. Morrison Gaither, Jr.,
August P. Gompf,
*Carroll T. Harris,
*Parr Hooper,
*Charles R. Johnson,
George Johnson,
William B. Johnston,
George W. Kelly,
*Edwin F. Koester,
John Louis Krauss,
Robert W. Kroeger,
August J. Kutzleb,
Joseph H. Letzer,
*Lewis W. Link,
Thomas M. Linthicum,
William H. Long,
Edward D. Lynch,
*Howard B. Lyon,
*William E. McComas, Jr.,
Charles L. Maas,
*Louis Mardaga,
Eugene D. Milener,
Charles W. Miller,
Harry G. Miller,
J. Monroe Murphy,
William N. Neibich,
Dudley F. Nicholson,
*Frank Neumann,
John B Norris, Jr,
J Marshall Page,
Edgar Parrish,
Abbott L Penniman,
Ferd H. Plack,
Edwin A. Plitt,
Henry R. Rausch,
Charles M. Reed,
Ramsay G. Regester,
*Richard G. Reese,
Arthur Rhoads,
John J. Rodemeyer,
John K. Ruff,
Andrew Rutter,
Albert H. Samuel,
Henry F. Schneider,
Jacob Schmidt, Jr.,
L. Wilson Scott,
Thomas C. Slingluff,
Charles L. Steel,
Samuel P. Stewart,
Jay W. H. Stoudenmire,
George W. Tall, Jr.,
*Perry McKee Teeple,
Carroll A. Turner,
Robert B. Turner,
Leo Tyser,
Charles P. Vogel,
M. Leeson Walsh,
Frank J. Wheeler, Jr.,
*F. Carey Williams,
John A. Woodfield,
P. Chancellor Wroe,
*Roy A. Yingling,

MID-YEAR CLASS OF 1911 — 17 MEMBERS.

K. C. Ascherfeld,
Alois Baer,
John Z. Bayless,
Ira L. Berg,
J. Edgar Bryan,
T. Earle Cooper,
E. Ellsworth Hall,
Frederick Hall Jones,
Henry Frank Krumm,
John A. Lindner,
Charles Linhardt, Jr.,
Harry McCauley,
Frank A. Nickols,
William Schaefer,
Norman Price Stansbury,
Percy P. Turner,
Eugene L. Wolfe.

CLASS OF 1911 — 112 MEMBERS.

John B. Adt,
Leroy Andrews,
*Wilmer E. Bader,
*Wilson T. Ballard,
*John R. Bangs, Jr.,
Gordon Barry,
Charles P. Bartgis,
J. G. Bauernschmidt,
Charles F. Bevan,
George W. Black,
*John Bohnlofink,
John George Bobb,
Alan Falconer Bristor,
*W. C. Brooke,
Landon M. Brooks,
Tallant Brooks,
Walter A. Brown,
*Charles S. Burlingham, Jr.,
John J. Clancy,
Guy Clemmitt,
Burnett Collmus,
Ford Coursey,
Charles R. Cox,
*Alan F. Cummings,
Paul N. Darrington,
*Edgar H. Dix, Jr.,
Edward Gorsuch Duncan,
G. Middleton Edwards,
*Howard Elliott,
Edgar M. Fluharty,
J. George Forster,
Donald Frames,
Charles P. Frank,
Harry B. Gaither,
*Benj. Goodman,
Leroy S. Green,
*S. T. W. Green,
J. Frederick Gross,
Julius F. Haegel,
*Simon Halle,
Rudolph Heinekamp, Jr.,
Andrew Heubeck,
*Arthur Holston,
Harry B. How,
Percy Wm. Richard James,
Robert E. Kaestner,
J. Dennis Kavanaugh,
*Cyrus J. Kearney,
*Claude W. Keefer,
Joseph M. Kemp,
Charles A. E. King,
*Frederick M. Kipp, Jr.,
Louis Krauss,
Samuel Krotee,
Owens Laws,
A. Bruton Leonard,
Sigmund Leskawa,
George R. Loftus,
*Christopher Loos,
James H. McKay,

*Erwin McLaughlin,
Eugene Maulsby Martenet,
Walter Mason,
*Samuel H. Mazer,
Herbert Meinl,
Henry F. Michael,
Fred. Michel,
*Theodore Morrison,
Charles L. Negley,
Clarence Norris,
William B. O'Connor, Jr.,
William J. Parrott,
H. Emory Peddicord,
*George C. Pfaff,
William C. Pinschmidt,
Milton C. Polster,
*Charles W. Price,
*Walter F. Quast,
George J. Ramming,
Herman Raushenbach,
William G. Richardson, Jr.,
*Ernest F. Ritterhoff,
*Gordon Robinson,
Arthur Schaefer,
*Ernest Schaun,
*John Shoolbred, Jr.,
John Sendelbach,
*Aaron Shalowitz,
Oliver D. Shepard,
*W. Carleton Short,
Alfred B. Smith,
William T. Snyder,
G. Nelson Sohl,
J. Henderson Spafford,
Carl E. Spott,
George W. Steinmetz,
John A. Sternberg,
E. Willard Taylor,
Robert G. Tippett,
*Willard W. Troxell,
*Ellwood W. Vail,
Ferdinand E. L. Wich,
Otis G. Wilbur,
*L. Earl Wilson,
L. Victor Winchester,
Charles Witte,
*Harry M. Wood,
*Curtis L. Woolford,
Conrad Zieget, Jr.,
*Julius O. Ziegfeld,
T. Jackson Zimmerman,
Ernest C. Zacheuschler.

MID-YEAR CLASS OF 1912 — 45 MEMBERS.

George Bailey,
John Becker,
George Orville Bigelow,
Clarence A. J. Birnbaum,
Howard Leo Border,
Oliver Boucher,
Paul Burwell,
Middleton Jerome Childs,
Howard T. Cromwell,
James H. Cullen,
Paul R. Dankmeyer,
Hyman G. Dansick,
Wilmer Ehlers,
J. Carroll Finnan,
*Frederick J. Goetze,
Robert Gover,
Sylvan Gusdorff,
Jacob M. Hecht,
L. K. Hill,
M. Edgar Iglehart,
C. D. Joesting,
Frank T. Jones,
Philip H. Keinner,
Allen D. Keyser
Walter F. Lamley,
Frank La Motte,
Roger L. Leilich,
Paul R. Lotz,

*F. Harrison MacCarthy,
William F. McConnor,
Anthony J. Mackiss,
Frank Phillips Merry,
C. E. Osenburg,
George M. Parr.
Eaward S. Poole,
G. Harvey Porter,
Charles Elmer Reynolds,
*J. Harry A. Schad,
Carroll E. Seabrease,
*Edward C. Seibert,
W. A. Steger,
Frank M. Sweeney,
Abraham Tobias,
Paul H. White,
Preston S. Wicks.

CLASS OF 1912 — 188 MEMBERS.

*William C. Andrae,
R. Nelson Atwell,
George Ault,
Frederick H. Baker,
Laurence Baldwin,
J. Carroll Bartholow,
Charles R. Baughman,
Stanley M. Bell,
*George Beneze,
Edward P. Benson,
Thomas W. Bollman,
E. Harold Bowen,
Wm. Wallace Bratt,
Kennard Bridges,
*Arthur F. Brownley,
Leroy B. Buckingham,
John W. Bullock,
Raymond Burgesser,
Lyle H. Burton,
Thomas Carnes,
Frank Henry Carter,
W. Logan Cassell,
Elwood L. Chase,
Howard W. Chew,
James Clancy,
J. Albert Clark,
Austin E. Clayton,
*Davis J. Cloward,
*Hyman A. Cohen,
Harry A. Collett,
E. Constam,
Roger Bernard Copinger,
*William Day,
Mark S. DeHuff,
Carl S. Delano,
Wylie G. DeMoss,
C. Edwin Dennis, Jr.,
LeRoy R. Disney,
Stanley P. Donovan,
C. Mervyn Dorsey,
J. Watson Downes,
P. Richard Drenning,
Samuel Eby,
C. Raymond, Ehrhardt,
Thos. S. Eichelberger,
Elmer Elgert,
Howard E. Elliott,
C. Clinton Emich,
H. Stockton Ewell,
Vernon D. Ferguson,
Edwin Fitzell,
Herbert Foster,
Richard Freas,
*Albert Frey,
Harry Fried,
*Arthur D. Fulton,
*Alfred M. Gagneux,
Sidney F. Galvin,
C. L. Garrett,
Frank Gartside,
Harry A. Goldberg,
Maurice H. Goldberg,
William S. Graham,
*Earl L. Greene,
Otto Paul Gronert,
Theodore Warren Hacker,

*Edward A. Hain,
Franklin B. Harper,
*Walter Harrison,
W. F. Harrison, Jr.,
James Warren Hartman,
W. J. Heimiller,
Karl Heineman,
Clarence H. Heisse,
J. Wilbur Heisse,
James W. Higgins, Jr.,
Clarence Lee Hill,
Charles A. Hiss,
James C. Hopkins,
D. C. Hopper, Jr.,
Frank C. V. Horlebein, Jr.,
*C. H. Horn,
J. Henry Horn,
Stedman Houghton,
George E. Hull,
Morris Jacobs,
Thomas Worth Jamison,
John C. Jaworsky,
Clinton M. Jones,
Frank P. Karger,
J. Kauffman,
*Kenrick Kelly,
Clarence D. Knight,
Paul B. Koons
Harry O. Korff,
*Abraham N. Krieger,
Irvin G. Kroll,
Edward J. Kuehn,
Benj. Lasinsky,
*Edgar Laughlin,
Allen D. Lazenby,
*Herbert Lee,
Francis Marion Lentz,
*Eugene B. Link,
Frank W. Littleton,
Walter Lloyd,
Frank Lucke,
Raymond Long,
William E. McClure,
Marion P. McComas,
Joseph T. Martin, Jr.,
Joaquin R. Masferrer,
Alex. Craig Meikle,
*C. Alexander Mengers,
J. Newton Merritt,
Paul Messersmith,
*J. Edward Metzbower,
Louis Michaelson,
*Rudolph Michel,
W. R. Moore, Jr.,
*William H. Munroe,
*Alfred S. Niles, Jr.,
Harry R. Noel,
J. Hewes Onion,
M. Oppenheimer,
*Raymond C. Parlett,
Clifton Pruett,
A. J. Quinan,
*Gustav Rasch,
Robert A. Reitz,
John Raymond Rickert,
James Joseph Riley,
W. Emerald Ring,
Harold Robinson,
Graham Rodemeyer,
Henry Roschen,
Reuben Rosenstein,
Abe Rosenthal,
Raymond W. Russell,
G. Hulbert Sack,
*William H. Sandlas,
J. Leon Sarbacher,
*J. Albert Schad,
Lester A. Schloss,
Ralph Schapiro,
*Eric E. Schmied,
Fred Schmidt,
J. Edward Schmidt,
*Howard Schuster,
Hanson Seal,
Louis E. Shilling,
William H. Solomon,
W. E. Stackhouse,
Charles H. Spence,
*C. Raimon Stivers,
J. Charles Strott,

Edwin M. Talbott,
Medford Talbott,
James B. Tarr,
*Edward J. Thomas,
Samuel LeRoy Thomas,
Charles Tiemeyer,
James Preston Tippett,
*Frederick C. Traub,
Oliver Travers,
Allan E. Turner,
Spencer Unglaub,
John William Wagner,
George E. Waldkoenig,
Carl H. Walker
William F. Walker, Jr.,
*J. Leonard Walsh,
*Sigurd Walter,
C. Raymond Ward,
Rowe C. Ward,
Andrew E. Warner,
*Charles B. Watkins,
Carroll H. Weatherly,
Charles F. Webb,
James Smallwood Webb,
Armsby P. Webster,
Stevenson White,
Paul Whittington,
Chrystal Williams,
Stewart James Wilson,
Reuben Wisthoff,
Edward Wohrna,
*T. Robey Wolfe,

MID-YEAR CLASS OF 1913 — 55 MEMBERS.

Joseph Argabright,
*Abram Bacharach,
H. D. Bartholomee,
Egar Boeckner,
*Carlyle E. Boone,
*Edward W. Borst,
Leigh A. Brodie,
Frank Albert Cesky,
Ralph H. Cline,
Laurence E. Collins,
E. Stanley Davis,
Euripides DeCastro,
N. R. Fahlen,
R. F. Gaddis,
George Gammont,
G. H. Gerhold,
Joseph Goldstein,
George A. Graham,
Guy Gray,
Clarence Guise,
S R. Hall,
Edward Albert Hampson,
Joseph Hannibal,
W. J. Harnett,
Roswell C. Haynie,
John Heiner,
Walter Hess,
H. V. Houser,
Isidore Isaacs,
E. E. Kaiser,
*Laurence C. Kaspar,
*William J. Kellinger,
W. Rouse Kelly,
Wilmer Kirkwood,
Alexander Klitch,
Eugene H. LaMar,
Wm. T. Leinweber,
L. T. Lenderking,
*Julius Levine,
Laurence Meekins,
A. C. Meyer,
P. B. Milburn,
William Miller,
*Carroll Morrison,
Gordon Parks,
Charles Pumphrey,
William Sapp,
Milton C. Smith,

W. A. Tapscott,
H. J. Timm,
Bernard Trautman,
Isaac Tretick,
Sidney N. Wolman,
William E. Wood,
Paul Wolf.

CLASS OF 1913 — 319 MEMBERS.

A. Aaronson,
Lyman Sinclair Abbott,
Wm. Tayler Abercrombie.
John Henry Adams, Jr.,
Walter S. Allen,
Alphonso Alcarese,
Samuel Amos,
Ronald F. Anderson,
Herbert Armiger,
Albert M. Armstrong,
James R. Armstrong,
Lloyd Wm. Ashley,
Frederick Lawrence Balliere,
Kenneth R. Barnes,
Ralph Emerson Barnes,
Rawlings Beaumont,
Charles A. Becker,
Wilbur Benfer,
Edward Benisch,
Charles H. Bensel,
Samuel W. Blankman,
Joseph Saunders Bohannon,
Francis H. Bopp,
Walter Andrew Bowers,
Philip W. Bowman,
J. Milton Boyer,
Edward Dennis Boylan,
Elmer Breckenridge,
Henry Lyman Broening,
Joseph Rodney Brooks,
John B. Brower, Jr.,
Edward H. Brown,
H. Price Bryan,
William G. Bursnall,
Maurice Bushman,
E. F. A. Buxton,
Arthur Clifford Carlton,
George W. Carmichael,
William Robert Carr,
J Bernard Carter,
Clay Carroll,
Theo. M. Chandlee,
Milton F. Clary,
Edwin C. Clayton,
Paul Clemmitt,
James E. Cochran,
Charles Cohen,
Solomon Cohen,
Paul L. Conway,
Charles E. Cordle,
Andrew J. Cromwell,
Edward Cushman,
Earl Cutino,
B. Francis Dashiell,
Henry Rogers Davis
Hugh Walter Day,
Parlett Davis,
Charles A. Desor,
Theodore M. Dew,
Henry Dippoldsmann,
Carl Philip Doenges,
Gustav Doroff,
J. Rowland Doxzon,
Elmer E. Duvall, Jr.,
Clarence Edward Earl,
Charles G. G. Eigenbrot,
George H. Elliott,
H. Crawford Emich,
Evald Michael Enstam,
G. Edwin Ernest,
Clyde Fallin,
John Joseph Farley,
Ellis Finkelstein,
Kennard W. Fischer,

Leonard C. O. Fleischmann,
Thomas J. Fluharty,
Thomas Carroll Ford,
Alfred Fort,
Harold Hirsh Fox,
Lucien Louis Friez,
Robert Reardon Fusselbaugh,
H. Owens Gale, Jr.,
H. Field Gambrill,
William Garmer,
Frederick George Gephart,
Carroll R. German,
William Ferdinand German,
Henry A. Giese,
Lawrence S. Gilpatrick,
Raymond, S. Glover,
Alfred Goldberg,
Benj. Goldberg,
Harry G. Goldman,
Leroy C. Goodman,
Allen W. Goodwin,
Milton R. Gosweiler,
Robert Proctor Grace,
Leroy Vollmer Graham,
William McL. Graham,
Charles H. Grauling,
George W. Green,
Robert Tyson Greer,
Charles F. Gross,
Harry Gross,
William Grotzinger,
Robert Fulton Gunts,
George K. Haderman,
Alexander W. Hamill,
Otto H. Hamm,
Charles J. Hammer,
Edwin Fulton Hanna,
Leslie Harrison,
David T. Harper,
Robert M. Hart,
George Leitch Hartman,
Lester Hartman,
Charles L. Haslup,
William Heaphy,
Carl A. Hechmer,
Joseph V. Heil,
Maurice M. Heimiller,
Frederick J. Heiner,
Fritz J. Heldrich,
Carroll J. Hennick,
William Henning,
Walter Ray Hershfeld,
Edward Russell Hicks,
Robert Holliday Hicks,
Thomas Russell Hicks,
John B. Hill,
Irving H. Hofmann,
Austin Holzer,
Wahlie Holtzman,
Charles W. Houck,
I. Luther Houghton,
Archer H. Howard,
Robert H. Hughes,
Elmer Y. Johnson,
Winfred E. Johnson,
Tully Alfred Joynes,
Charles Kagle,
Henry Kahl,
J. Maurice Kauffman,
L. Keimig,
Franklin Kelley,
Oliver M. Kelly,
James W. D. Kibler,
Emory Kirwan, Jr.,
Howard Klingelhofer,
P. Hoffman, Knatz,
Geoffrey Koefoed,
George Kohlhepp,
Henry Wempe Korpman,
Frederick H. M. Kraus,
William Fritz Kuehle,
George Eugene Lang,
Ernest Hooper Langrall,
Clement E. Leimbach,
Gustav Lentz,
Jacob Levin,
Alfred C. Levis,
C. Harold Lickle,
Donald Linville,
Francis A. Litz,

Robert B. Lytle,
Leslie M. McKay,
John Wardale McAllister,
Arthur S. McCabe,
Joseph C. McGinnis,
S. Raymond Machen,
Charles E. Manger,
Cyril Henry Atwood Markley,
Ralph W. Martin,
Herbert Russell Mason,
C. O. Mattfeldt,
Edwin Matusevitz,
Howard B. Merry,
Louis Meyerhoff,
Charles William Meyers,
George May Meushaw,
Whitney Thomas Meushaw,
Donald A. Millar,
Alvin Miller,
Charles W. Miller,
Harry Miller,
Louis Nelson Miller,
Vernon Minks,
Ernest Minor,
Leonard C. Moltz,
Edgar A. Mueller,
Max W. Muller,
Cecil H. Mullikin,
Melvin A. Meyers,
Sidney M. Nealy,
Henry M. Needham,
Charles Thomas Newton,
Leroy S. Nicholson,
Edward H. Nunn,
Walter O'Brien,
Herbert Oliver,
Anton P. Orban,
William H. Osbourn,
Vincent Parettiere,
Harry Smyser Parsons,
Edward Joseph Paulus,
Herbert Allyn Payne,
Charles Edward Peacock,
Kenneth L. Peddicord,
George Eldren Peregoy,
Leon Piloto,
Joseph Pinero,
Landra Beach Platt,
William Richard Poetter,
Isaac Poloway,
R. Lee Porter, Jr.,
Charles Henry Poumairat, Jr.,
John O. Preston,
Milton Allender Pyle,
Oden Bowie Pyle,
Jesse Lee Pyne,
F. Raymond H. Rahn,
Edward Ramer,
Reinaldo Ramirez,
Raymond August Rapp,
Mabbett Reckord,
William Elmer Reese,
Milton Reiner,
Frank K. Reinhardt,
Lawrence Tisch Reinicker,
George W. Rice,
Wilson Richards,
George C. Rigor,
Harry Louis Robinson,
James Joseph Rock,
Henry P Rodgers,
Lloyd R. Rogers,
Harry Rosenthal,
Hamilton W. Rouse,
Scott Runge,
George Russell,
H. Vernon Russell,
Campion Rush,
John Henry Rutter,
Philip Sampson,
Claude M. Satterfield,
John S. Schad,
Theodore Schad,
Benjamin Schloss,
Emanuel C. Schlueter,
Norman John Schnepfe,
Charles O. Schobel,
Evans Schofield,
William Schultheis, Jr.,
Charles McKinley Schultz,

William F. Schwartz,
Leslie Sebald,
John K. Sees,
John Jacob Seidel,
LeRoy Elmer Seward,
George McClellan Shamer,
George L. Shaw,
Robert W. Sheckells,
Thomas Shehan
Creston C. Shelley
Joseph B. Shirkley
Walter G. Simon
Carroll Sinclair
Jacob Sindler,
Everett G. Smith,
James George Smith,
William E. Smith,
J. Rogers Sohl,
James T. Sollers, Jr.,
George Paul Spates,
Herbert A. Spott,
John Stansbury,
Felix B. Stifler,
Melvin Stinefelt,
Robert L. Strauss,
Merritt Streckfus,
J. Otis Tall, Jr.,
George C. Tapman,
Frank Thomas,
Percy B. Thomas,
Henry Thielemann,
Edwin L. Tompkins,
Charles Thompson,
Hubert Thompson,
Albert N. Tiemann,
Frederick Tiemeyer,
Ernest Tschudy,
Clarence Eugene Vadala,
Peirce Van Vleck,
Frederick R. Vinup,
Harry Vogelstein,
Herman A. Von Eiff,
Lawrence Votta,
Herrmann Wacker,
William Darrell Wagner,
Carlisle M. Walker,
Joseph A. Walker,
Gustavus Ward,
J. Roy Warner,
Walter Joseph Warnock,
Willis G. Weaver,
Samuel Weinstein,
Wellington Weis,
Josephus Leonard Welsh,
William Norman Wherrett,
Kenneth Whitcomb,
August Wilhelm, Jr.,
William Herbert Wilhelm,
John Albert Williams,
Lewis Williams,
John E. Wrenn,
W. Carlisle Wroe,
Edwin Gray Yearley,
D. D. F. Yellott,
Howard Edward Ziefle.

MID-YEAR CLASS OF 1914 — 47 MEMBERS.

Clarence E. Becker,
Randle L. Biden,
Samuel John Bien,
Henry Caula,
Dominick Corrieri, Jr.,
Thomas R. Crawford,
Edwin Winter Crouch,
John De Marco,
Joseph De Marco,
Charles Raymond De Muth,
George Justus Dimling,
Hayward Faithful,
Edward Henry Frederick,
Paul Grafton,

George Hammond,
George D. Harman,
Walter Holtgreve,
Edward Carleton Hood,
David D. Kennedy, Jr.,
Edward Langschmidt,
Leslie L. Lewis,
Harvey F. McLaughlin,
William Oliver Miller,
Egar Manville Myers,
Morris G. Myers,
William L. Payne,
James W. Pierpont,
James Elmer Poehlman,
Vytant V. Rudis,
William H. Sarbacher,
Frank X. Schloer,
John N. Schmidt,
John Norman Sewell,
Louis Simon,
Robert Sommerwerck,
Arthur T. Spies,
Walter Andrew Spies,
Harry Ellsworth Steffey, Jr.,
George Gladstone Talbot,
William T. Wade,
Herbert Walter,
Wallace C. Warner,
Louis Weissing,
Monroe Whaley,
Jesse Williams,
Vance Vernon Wilson,
James H. Woodall.

SUMMARY OF ENROLLMENT.

Class of 1910, A Class	78
Mid-Year Class of 1911, Ax Class	17
Class of 1911, B Class	112
Mid-Year Class of 1912, Bx -Class	45
Class of 1912, C. Class	188
Mid-Year Class of 1913, Cx -Class	55
Class of 1913, D Class	319
Mid-Year Class of 1914, Dx Class	47
Total enrollment	861

CLASS ORGANIZATIONS.

CLASS OF 1910 — A CLASS.

President......................Howard B. Lyon.
Vice-President..................Thomas C. Slingluff.
Secretary......................John B. Norris, Jr.
Treasurer......................George Johnson.

MID-YEAR CLASS OF 1911—AX CLASS

President......................John Z. Bayless.
Vice-President..................J. Edgar Bryan.
Secretary......................Percy P. Turner.
Treasurer......................Norman P. Stansbury.

CLASS OF 1911—B CLASS.

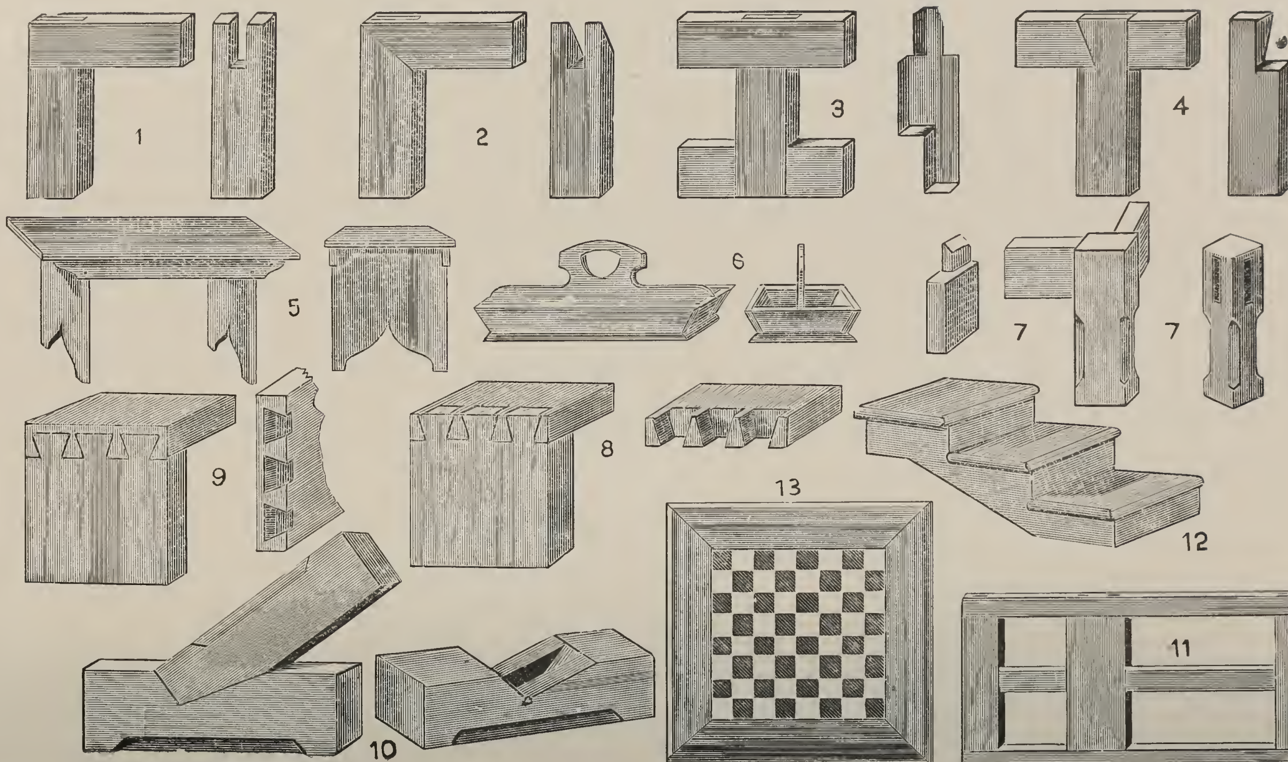
President......................Julius O. Ziegfeld.
Vice-President..................Frederick M. Kipp, Jr.
Secretary......................Edgar H. Dix, Jr.
Treasurer......................G. Nelson Sohl.

MID-YEAR CLASS OF 1912—Bx CLASS.

President......................Paul H. White.
Vice-President..................Charles E. Reynolds.
Secretary......................J. Harry A. Schad.
Treasurer......................C. E. Osenburg.

CLASS OF 1912—C CLASS

President......................Eric E. Schmied.
Vice-President..................Carroll H. Weatherly.
Secretary......................Albert Frey.
Treasurer......................Stedman Houghton.



CARPENTRY.

MID-YEAR CLASS OF 1913—Cx CLASS

President......................Carroll Morrison.
Vice-President.................R. F. Gaddis.
Secretary......................Julius Levine.
Treasurer......................Joseph Hannibal.

CLASS OF 1913—D CLASS.

President......................Francis A. Litz.
Vice-President.................Howard R. Merry.
Secretary......................Robert H. Hughes.
Treasurer......................Henry P. Rodgers.

LITERARY SOCIETIES.

The "Lowell"

President......................Jacob Blaustein, '10.
Vice-President.................Robert E. F. Aler, '10.
Recording Secretary............Fred. Michel, '11.
Corresponding Secretary........Joseph Letzer, '10.
Treasurer......................Perry McKee Teeple, '10.
Sergeant-at-Arms...............G. Nelson Sohl, '11.
Reporter.......................Edwin A. Plitt, '10.

Executive Committee...... { Laurence B. Chenoweth, '10.
Wilbur N. Van Sant, '10.
The President, ex-officio.

On December 19, 1909, the question, "Resolved: that a Federal income tax law, its constitutionality being granted, should be adopted by the United States Government," was publicly debated at the Eastern High School by a team from the Lowell and one from the Bancroft Literary Society of the Baltimore City College. The Bancroft Society representatives upheld the affirmative, and the Lowell supported the negative. The debaters representing the the Lowell were Laurence B. Chenoweth, '10; Jacob

Blaustein, '10; Wilbur Nicholas Van Sant, '10; and Perry McKee Teeple, '10, alternate. A majority of the judges, Messrs. James W. Chapman, Robert Barnett and Hans Frolicher, decided in favor of the Bancroft.

The "Poe."

President.................. Carroll T. Harris, '10.
Vice-President.............. Howard B. Lyon, '10.
Secretary.................. W. H. Barnard, Jr., '10.
Treasurer.................. Julius O. Ziegfeld, '11.
Librarian.................. Conrad Zieget, Jr., '11.
Reporter.................. Claude W. Keefer, "11.
Historian.................. J. F. Gross, '11.
Sergeant-at-Arms............ John Byrd Norris, '10.
Critic...................... Mr. William P. Stedman.

Executive Committee....... George B. Farlow, '10.
Parr Hooper, '10.
The President, ex-officio.
Herbert A. Ehrman, '10.

Business Committee........ Chas. Reid John, '10.
Vice-President, ex-officio.

On June 18, 1909, the Poe-Lowell Literary Societies gave their annual play in the auditorium of the Eastern High School. The play selected was "The Dictator" and was presented very successfully by the following cast of characters:

Brook Travers, alias "Steve"....R. Brooke Maxwell.
Jim Simpson, his valet.........Walter F. Perkins.
Hyne, the wireless operator.....Frederick B. Abbott.
Col. John T. Bowie, the American
Consul....................Laurence B. Chenoweth.
Duffy, a secret service detective. Jacob Blaustein.

Rev. Arthur Bostick, a missionary........................Wilson N. Gambrill.
General Campos, president of San-Manana................Louis Cremona
Senor Jose, the hotel proprietor..Wm. T. Hanzche.
Lieut. Perry, of the U. S. S. "Oregon"..................Franklin E. Holland.
Capt. Codman, of the "Bolivar".Abbot L. Penniman.
Dr. Vasquez, a health officer....Franklin E. Holland.
Col. Garcia, aid to Campos......Perry McK. Teeple.
Corporal Manuel...............Roy D. Fleckenstein.
Steward.......................Guy C. Clemmitt
Miss Lucy Sheridan............Wilbur N. Van Sant.
Mrs. John T. Bowie............Carroll Timanus Harris.
Juanita, a Spanish woman......Luis A. Deliz.

SOLDIERS

Wm. H. Barnard,
W. T. Snyder,
C. J. Flayhart,
C. Kearney.

SAILORS.

J. E. Yewell,
L. Thompson,
C. C. Ascherfeld,
A. L. Penniman,
H. L. Weaver,
C. R. Johnson.

POLICEMEN

H. L. Weaver, C. Burlingham.

THE PARKMAN HISTORICAL SOCIETY

During the year 1908-1909 a number of first year students formed an organization at the Polytechnic Annex for the study of history. Some of these students, upon being promoted to the second year class, desired to continue this study and, with the co-operation of the Department of History and Civics, formed an organization in October, 1909 which includes in its membership students of the third and fourth year classes. This body is known as the Parkman Historical Society, and has for its objects the study and discussion of historical and civic topics.

The following are the officers of the society:

President......................G. Nelson Sohl, '11.
Vice-President.................Alfred S. Niles, Jr., '12.
Secretary..................... J. Frederick Gross, '11.
Treasurer..................... C. Warfield Keefer, '11.
Librarian ....Davis J. Cloward, '12.
Sergeant-at-Arms.............. Ernest Schaun, '11.
Critic........................Richard Freas, '12.

THE MACAULAY HISTORICAL SOCIETY.

At about the same time that the Parkman Society began its career, the Macaulay Historical Society of the Polytechnic Annex was organized, with the following officers:

President..................... V. P. Panettiere.
Vice-President.................M. Bushman.
Sergeant-at-Arms..............J. W. McAllister.
Secretary.....................J. Brower.
Treasurer.....................J. Sindler.
Critic........................L. Friez.
Librarian..................... E. Reese.
Reporter......................E. F. Buxton.

THE "IRVING."

In September, 1908, members of the first year class at the Annex, encouraged by "Lowell" and "Poe" influences, organized "The Irving Literary Society," having for its object the furtherance of the literary spirit in school life.

The following named are the present officers:

President.................... Solomon Cohen.
Vice-President...............W. A. Bowers.
Secretary.................... V. P. Perettiere.
Treasurer....................Edwin Buxton.
Critic.........................Robert Hicks.
Sergeant-at-Arms.............Taylor Abercrombie.
Reporter......................J. A. Williams.
Librarian.................... G. L. Hartman.

THE ORCHESTRA

Director....................Frank Neumann.
Manager....................Conrad Zieget.
Frank Neumann.................... First Violin.
Paul L. Lotz........................ First Violin.
Theodore Morrison..................Second Violin.
Aaron Shalowitz.....................Second Violin.
C. Alexander Mengers...............Piccolo.
Conrad Zieget, Jr..................... First Cornet.
J. George Forster....................Second Cornet.
Julius O. Ziegfeld...................Piano.

ATHLETICS.

THE ATHLETIC ASSOCIATION.

The fundamental basis upon which rests the organization of the Athletic Association is the elevation of schoolboy athletics. It seeks to establish honor, self-restraint, and

courage above victory. It provides suitable apparel and safety devices for contestants in order to lesson the chances of injuries, and endeavors to shape the coaching and training on hygienic principles. It permits any student of the Institute to become a candidate for any team or squad which represents the school in athletic contests, provided his scholastic standing is of the required standard.

To make the association thoroughly representative of the student body, each section of a class is accorded a representative on the Athletic Board, which secures a representative ratio of 1 in 30.

ORGANIZATION OF THE ATHLETIC ASSOCIATION.

President...................... John Z. Bayless.
Vice-President.................. Andrew Heubeck.
Secretary........................ John B. Norris, Jr.
Treasurer....................... Mr. Samuel P. Platt.

ATHLETIC BOARD.

George B. Farlow, '10.
John B. Norris, Jr., '10.
Thomas C. Slingluff, '10.
John Z. Bayless, '11.
H. Emory Peddicord, '11.
Andrew Heubeck, '11.
William T. Snyder, '11.
W. Carleton Short, '11.
Frank M. Sweeney, '12.
Roger L. Leilich, '12.
R. N. Atwell, '12.
Laurence Baldwin, '12.
R. C. Parlett, '12.
E. E. Schmied, '12.
L. E. Shilling, '12.
Howard Schuster, '12.
F. A. Cesky, '13.
Gordon Parks, '13.
Landra Platt, '13.
Mabbett Reckord, '13.
Philip W. Bowman, '13.
Parlett Davis, '13.
Emory Kirwan, '13.
Sidney Nealy, '13.
Donald Linville, '13.
Maurice Bushman, '13.
Robert H. Hughes, '13.

BASEBALL.

The make-up of the baseball team of 1909 was:

Dalrymple (Captain), Drenning, Steel, pitchers; Jahn, Booth, catchers; Jones, Morris, 1st base; Clancy, 2nd base; Bullock, Drenning, 3rd base; Kaufman, short-stop; Yewell, left field; Tapking, centre field; Maxwell, right field.

Substitutes: Siems, Schaefer, Andrews, Flayhart.

The following is a summary of the games played:

Polytechnic, 8.... St. John's Reserves, 2.
Polytechnic, 3.... Revenue Cutter Cadets, 4.
Polytechnic, 2.... Revenue Cutter Cadets, 8.
Polytechnic, 11.... Loyola College, 12.
Polytechnic, 12.... Loyola College, 4.
Polytechnic, 0.... Charlotte Hall, 3.
Polytechnic, 4.... Maryland Agricultural College, 3.
Polytechnic, 6.... City College, 10.
Polytechnic, 5.... City College, 10.
Polytechnic, 8.... Mt. St. Joseph, 2.
Polytechnic, 3.... Johns Hopkins Freshmen, 1.

FOOTBALL.

For the second time in the history of the games between the two secondary schools of the city, the Poly team defeated the team of the City College at Oriole Park, November 19, by the decisive score of 11 to 0, thus duplicating the figures of the game of 1908 between the two teams.

The final scheduled game of the season, that with the U. S. Naval Academy Plebes, was canceled owing to the poor condition of the team due to injuries received in the City College game. It was deemed prudent to avoid a conflict between teams so unevenly matched at that period.

The following is a summary of the games played:

October 16, at Port Deposit—Polytechnic, 0; Tome Institute 21.

October 23, at Charlotte Hall—Polytechnic, 6; Charlotte Hall, 6.

October 30, at Annapolis — Polytechnic, 0; St. John's Reserves, 6.

November 6, at Ellicott City — Polytechnic, 6; Rock Hill College, 6.

November 13, at Millersville, Pa. — Polytechnic, 0; Penn. State Normal, 23.

November 19, at Oriole Park — Polytechnic, 11; City College, 0.

Nov. 25, game with Naval Academy Plebes canceled.

THE MARKSMEN'S CLUB.

The object of the Marksmen's Club is to create among the students an interest in marksmanship, that branch of athletics which develops a steady arm, a quick eye, and a manly self-reliance. It is composed of all the members of the school who can shoot or who wish to learn to shoot.

It was organized on October 7, 1909 by several of the members of last year's rifle team. Although a young organization it is flourishing and has more than fifty members. The winning of the interscholastic championship of the city by the team of last year has added a great deal to the interest in rifle practice.

The Polytechnic championship team of last year, captained by Mr. Allen L. Malone of the Department of Engineering, was composed of

W. T. Ballard, '11.	R. B. Maxwell, '09.
W. N. Gambrill, '09.	W. F. Perkins, '09.
C. T. Harris, '10.	C. A. Turner, '10.
W. D. Lambdin,'09.	M. A. Spamer, Mid-Year '10.
Parr Hooper, '10.	C. L. Steel, '10.

F. L. Purdy, '09, alternate.

The championship match was held at the Richmond Market Armory under the direction of Major S. J. Fort,

Range Officer of the Maryland National Guard, on March 27, 1909. The Public Athletic League, under whose auspices the match was held, presented the school with a trophy and each member of the team with a medal.

The officers of the club for 1909-1910 are:

President.............. Carroll T. Harris, '10.
Vice-President..........Morris A. Spamer, Mid-Year '10.
Secretary.............. Parr Hooper, '10.
Treasurer...............C. R. Johnson, '10.
Team Captain.......... Charles L. Steel, '10.
Recorder...............W. T. Ballard, '11.
Carroll A. Turner, '10, Chairman.Robert W. Kroeger, '10.
Abbott L. Penniman, '10. The President, ex officio.
Team Captain, ex officio.

Board of Managers.

Carroll A. Turner, '10, Chairman.
Abbott L. Penniman, '10.
Robert W. Kroeger, '10.
The President, ex officio.
Team Captain, ex officio.

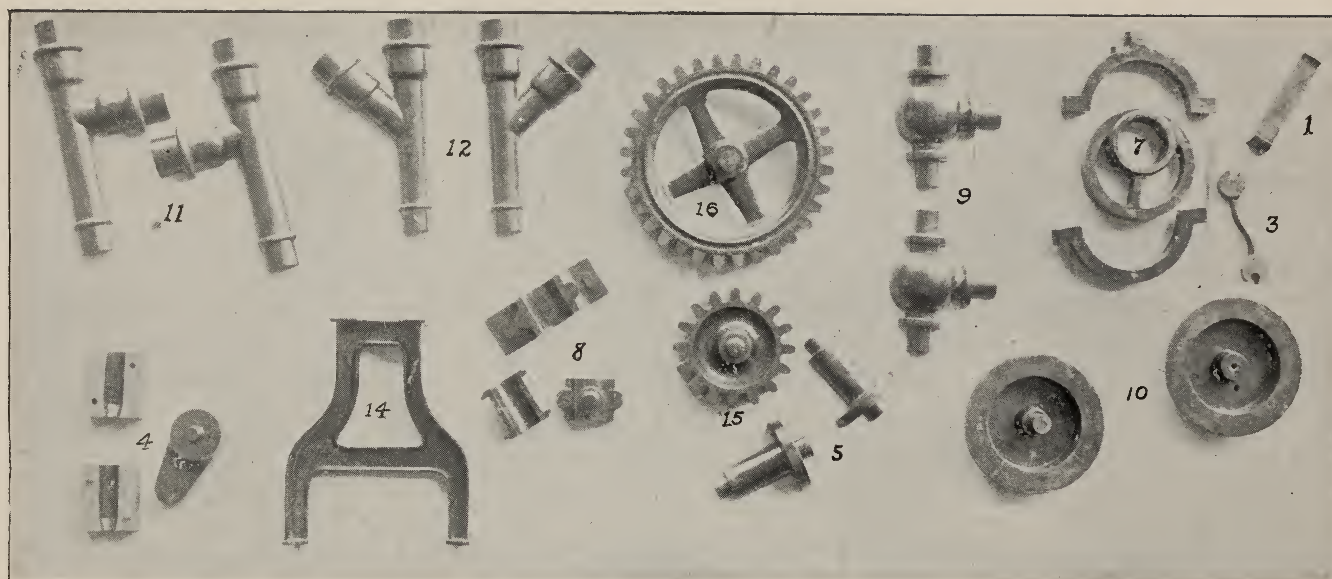
CATALOGUE OF GRADUATES.

CLASS OF '87.

Clarence G. Bouis,
George C. Bump,
Lucien Dallam,
Otto H. Ehlers,
Osma K. Gardner,
Herbert F. Gorgas,
Joseph Greenbaum,
Henry W. Hahn,
Minor F. Heiskell,
Robert Hooper,
William S. Hugg,
Thomas J. Irons,
Joseph H. Kuehn,
P. Charles Nelson,
Flavius J. Pennington,
Richard Piez,
Henry M. Price,
Walter G. Reinicker,
William A. Robertson,
Albert Rosenberg,
James B. Scott,
Walter R. Sweeney,
James C. Thompson,
Adolphus Tiemeyer,
Frederick H. Wagner,

CLASS OF '88.

Arthur O. Badendrier,
Edward Binswanger,
Bernard H. Brooke,
Sydney S. Bouis,
Julius Fireman,
Thomas G. Ford,
George M. Gaither,
John H. Harvey,
Howard Harvey,
Walter J. Herman,
Joseph H. Hooper,
John P. Jefferson,
William Johnston, Jr.,
William Mencke,
William F. Mylander,
Edwin F. Orem,
Edward B. Passano,
George E. Repp,
Harry E. Roberts,
George C. Robinson,
Hanson Robinson,
Robert E. Rodgers,
George H. Sickel,
Washington B. Stanton,
Orlando C. Weeks.



PATTERN WORK.

CLASS OF '89.

William F. Ackerman,
Samuel R. Adams,
Morgan H. Baldwin,
Arthur Gordon,
Ernest Griffith,
Isaac Behrend,
Joseph Isaac,
Louis H. Gerding,
Harry M. Ford,
Edward P. Cromwell,
John S. Hand,
Claiborne M. James,
Albert C. Layman,
Charles W. Leach,
J. W. C. Meikle,
Rozier L. Bouis,
Robert H. Buschman,
Charles C. Constantine,
Albert T. Barrett,
John L. Ehrman,
Allyn Field,
Howard Crosby,
George W Moog,
John K. Mount,
Robert W. Peach,
Charles E. Phelps, Jr.,
William G. Robertson,
Robert C. Round,
Myron S. Rose,
William C. Siegmund,
Joseph Stiefel,
Harry P. Suman,
Carroll Thomas.

CLASS OF '90.

John F. Abendschein,
G. S. Barnes,
J. H. Bokee,
J. Edward Broadbelt,
W. H. Farinholt,
Chris. Feick,
J. Froelich,
William P. Gundry,
E. C. Harris,
J. C. Mattoon,
John D. Pugh,
A. O. Robertson,
William F. Schultz,
Michael D. Schaefer,
William P. Shriver,
Theodore Straus.

CLASS OF '91.

Walter Amos,
Basil Benson,
William Benson,
William Boucsein,
Morde Bren,
John J. Caine,
George Dannetel,
Charles Ehlers,
Ferdinand B. Keidel,
J. Edgar Knipp,
Samuel McNeal,
James C. Phillips,
Herbert M. Reese,
Edmund W. Robinson,
Reuben Row,
Warren S. Seipp,
N. D. D. Sollers,
Richard S. Warner,
William A. Young,

CLASS OF '92.

Edwin W. Antes,
John P. Baer,
Frank J. Borie,
B. Harrison Branch,
Leonard Burbank,
William C. Butler, Jr.,
Frank B. Hooper,
Edgar N. King,
John Langford,
Louis Liepman,
R. M. Miller,
J. W. Dawson, Jr.,
Royal R. Duncan,
Charles R. Durling,
Isidor Deutsche,
Walter H. Eisenbrandt,
William T. Holmes,
J. C. Miller,
Joseph Mullen,
William H. Rose,
Albert G. Singewald,
William H. Soine,
William E. Straus.

CLASS OF '93.

Theodore H. Ackerman,
Herbert Addison,
Oregon R. Benson,
Percy Thayer Blogg,
C. Raymond Carson,
William John Cochran,
E. C. D'Yarmett,
Henry M. Fitzhugh,
Clarence S. Hand,
James F. McShane,
Clarence F. Morfit,
F. H. Phelps,
Edwin Schenck,
John R. Uhler,
L. Ismay Van Horn,
Charles P. Weishampel,
R. L. Williams.

CLASS OF '94.

Edward H. Bell,
Albert E. Bowen,
T. Straith Briscoe,
Harry Cotton,
Carroll Edgar,
Frederick Kopp,
Philip Littig, Jr.,
Thomas Q. McGinn,
Herbert A. McGaw,
Horace J. Miller,
Louis Mueller,
George M. Parlett,
Charles Schlicker,
Alan P. Wilson,
John Zeubert,
Pliny Cutler Hall,
Edward J. Herring,

CLASS OF '95.

George W. Brown,
Clifton A. Coggins,
Harry W. Francis,
Graham B. Hall,
William W. Hogendorp,
Albert J. Hooper,
Frank A. Hornig,
Howard L. Hoskins,
Edward M. Likes,
Ward P. Littig,
Alfred F. Loeser,
Thomas J. H. Magness,
Herman F. Myer,
George N. Rogers,
Hamilton D. Ruth,
Richard F. Weishampel,
Carl A. Witthaus.

CLASS OF '96.

Samuel Hosea Armstrong,
Howard Douglas Bennett,
James Gomelia Boss, Jr.,
William Augustine Boykin, Jr.,
Robert Lemmon Burwell,
Harry Parr Diggs,
Frederick L. H. Glendmeyer,
William Howard Hamilton,
Arthur Worthington Hawks, Jr.,
Fredk. Worthington von Stein,
Louis Kemp Henninghausen,
Harry Louis Homer,
Ludford Cohoon Jones,
Leon Alvyn Kohn,
Erich Albert Loeser,
Henry Louis Mencken,
Harold Vincent Patterson,
Harry Clay Powell, Jr.,
Gilmor Meredith Ross,
Thomas Quincy Scott,
Henry Bonn Silverthorn,
William Henry Smith,
Roscoe Conkling Sweeny,
Charles Edwin Wilson,
Olin Alexander Wilson,

CLASS OF '97.

Louis Fabian Bachrach,
Alan Marion Bennett,
William Melvin Carter,
Elvin Griswold Cromwell,
John Towson Elsroad, Jr.,
John Montgomery Gambrill,
Ernest Cummins Hatch,
William Hain Kirwan,
Harry L. Kugler,
Chester Waters Larner,
Howard Osgood Preston,
George Gottlieb Schnepfe,
Frederick Lewis Schwartz,
Joseph Stewart Smith, Jr.,
Douglas Alan Sparks,
Joseph Morrison Sparks,
Wilson Ward,

CLASS OF '98.

Thomas Jefferson Andrews,
Alan Joseph Bachrach,
Leo Bauerfeld,
Wilbur McKnew Bosworth,
Frederick Derick Dollenberg, Jr.,
Romulus Griffith Doyle,
John Howard Flayhart,
Henry Galloway,
Charles Raymond Gantz,
Samuel Thomas Griffith,
Alfred Cummins Hatch,
William Herman Hubers, Jr.,
Joseph Lowrie Ingle, Jr.,
John Scott Longnecker,
John Walter McGreevy,
Edward Harris Mealy,
William Charles Metcalf,
John Floyd Miller,
William Eldred Nolan,
Gurdon Tyler Pollard,
Walter Percy Poole,
John Maurice Rehberger,
John McCullough Rife,
Harry Rufus Ruse,
Paul Edward Schaun,
John Henry Sirich, Jr.,
John Smith,
Herbert Turner Snyder,
George Creamer Wilcox.

CLASS OF '99.

Charles E. Allen,
William B. Boettinger,
Harrison Brent,
Hugh W. Brent,
Edward Goodnow Clayton,
Edward P. Cooke,
Charles C. Crockett,
William W. Cushing,
Arthur Councilman Davis,
Charles H. Demitz,
Roland S. Focke,
Harry B. French,
Robert B. Harper,
Charles W. Held,
Ira Johnson,
George A. Knapp,
Walter B. Lang,
Harry Lowenthal,
George P. McCeney,
William E. McCord,
Marion H. McCoy,
Charles E. Mencken,
Charles T. Owens,
Edw. L. Schaun,
Harold B. Vincent,
Joseph A. Ward,
Charles C. Lucke,
John N. McCleester,
Blakely A. McDonnell,
Edwin G. O'Connor,
William Taylor Phipps,
Emanuel J. Sedlacek,
Frederick C. J. Sternat,
Joseph R. Walter,
William C. Whelan.

CLASS OF '00.

John Walter Fred. Blizard,
Roy Stevenson Houck,
Galt Fayette Parsons,
Gustave Frederick Linck,
Horace Kirk Faust,
Thomas Osborn Wansleben,
Samuel Moore Johnson,
Luther Chase Wright,
Walter Bowen Buttner,
Morgan Moore,
John Charles Masopust,
Walter Groverman,
Lawrence Gunton Allbutt.

CLASS OF '01.

Joseph M. Beehler,
C Ernest Conway,
William M. Demintz,
Charles F. Goob,
Richard G. Harris,
Irving C. Hess,
Charles W. Hoppert,
Carlisle L. Hubbard,
Edward E. Johnston,
Thomas H. Kenny,
Charles E. Lane,
Andrew J. Lowndes,
Ross E. Lynch,
Allen L. Malone,
Richard E. Marston,
Harry Mehrling,
John A. Raidabaugh,
T. Warden Rinehart,
William B. Rosenthal,
Edward Samuel,
John C. Siegle,
Walter H. Tapman,
Sidney C. Vincent,
George P. von Eiff,
Ernest B. Walton,
Arthur S. Weiss,
George K. Yost,
Philip H. Zipp,

POST-GRADUATE CLASS OF '02.
(Four Year Course.)

Joseph M. Beehler,
C. Ernest Conway,
Irving C. Hess,
Andrew J. Lowndes,
Allen L. Malone,
John A. Raidabaugh,
Sidney C. Vincent,
George P. von Eiff,
Philip H. Zipp,

CLASS OF '02.

Joseph A. Baldwin,
Frank O. Boyd,
John B. Cautley,
Robert Dall,
William L. De Baufre,
John K. Flickenschildt,
Walter M. Gieske,
Donald S. Hays,
Joseph T. Henthorn,
John S. Hess,
I. Seeley Jones,
D. Frank Lamble,
LeRoy M. Langrall,
H. Quimby Layman,
John G. M. Leisenring,
William N. Michael,
Charles A. Pettit,
William S. Samuel,
G. Forney Shryock,
Charles F. Yardley.

POST-GRADUATE CLASS OF '03.
(Four Year Course.)

John B. Cautley,
Robert Dall,
William L. De Baufre,
John K. Flickenschildt,
Walter M. Gieske,
Donald S. Hayes,
John S. Hess,
I. Seeley Jones,
LeRoy M. Langrall,
H. Quimby Layman,

Specials { Arthur C. Davis,
Charles A. Pettit.

CLASS OF '03.

Elmer Armiger,
Paul Backhaus,
Oscar F. Benjamin,
Owen C. Blades,
Harry N. Brannan,
Frank B. Burton,
William N. Crisp,
John W. Dorsey, Jr.,
Christopher J. Frank,
Milton H. Gross,
Harold M. Parsons,
Ernest M. Poole,
J. McDonnell Reid,
Martin J. Reynolds,
Edward Hering,
Charles E. Herth,
James B. Jones,
Milton Kraemer,
Herman Lucke, Jr.,
Edmund C. Lynch,
Arthur B. Marston,
Harry M. Mason, Jr.,
Sidney Newhoff,
Manly P. Northam,
August H. Schaaf,
Howard I. Schultz,
George F. W. Sims,
Wilmer T. Stone,

POST-GRADUATE CLASS OF '04.
(Four Year Course.)

Paul W. Backhaus,
Harry N. Brannan,
Wiliam N. Crisp,
Edward Hering,
James B. Jones,
Milton Kraemer,
Harry M. Mason, Jr.,
J. McDonnell Reid,
Martin J. Reynolds,
George F. W. Sims,
Specials
Frank B. Burton,
H. Milton Gross,
August H. Schaaf.

CLASS OF '04.

Chester A. A. Albrecht,
James B. Arthur,
Marion V. Bailliere,
Joseph Bowes, Jr.,
Andrew K. Brumbaugh,
Clarence C. Clickner,
Edward C. Cromwell,
Frederick L. Dixon,
Charles A. Edel,
Frank B. Fifer,
Emanuel Fritz,
George Gittelsohn,
J. Lyell Gressitt,
Edward J. Hecker,
John H. Hills,
Harry J. Hodes,
Benjamin F. Hoffacker,
Harry V. D. Hunt,
William C. Hurley,
Charles A. Langrall,
Herman W. Lasser,
Daniel J. Leary,
Leon Marmor,
Samuel May,
John L. Mosher,
Charles P. Niederhauser,
Robert G. Pangborn,
Massimo Pisani, Jr.,
George S. Robertson,
George M. G. Schaefer,
Leon Small,
Oscar E. Smith,
Marion Steinberger,
Harry D. Thurlow,
Harry Waldorf,
Charles W. Whittle,
Edwin L. Willson,
Louis A. Witte,
William P. Wittmer,
Alexander H. Wöollen,

POST-GRADUATE CLASS OF '05.

Chester A. A. Albrecht,
James B. Arthur,
Joseph Bowes, Jr.,
Edward C. Cromwell,
John W. Dorsey, Jr.,
Charles A. Edel,
Frank P. Fifer,
Emanuel Fritz,
J. Lyell Gressitt,
Richard G. Harris,
Edward J. Hecker,
John J. Hills,
Benjamin F. Hoffacker,
Harry V. D. Hunt,
Charles A. Langrall,
Samuel May,
John L. Mosher,
Robert G. Pangborn,
Massimo Pisani, Jr.,
Leon Small,
Marion Steinberger,
Harry DeG. Thurlow,
Harry Waldorf,
Edwin L. Willson,
Alexander H. Woollen.

CLASS OF '06.

H. Roy Anderson,
Moses Appel,
Walter K. Bachrach,
Harry C. Becker,
J. Ralph Bolgiano,
William Wallace Boyd,
G. Herman Carl,
Willis B. Clemmitt,
Charles H. Dorsey,
George Erck,
Harry C. Finck,
Edwin Friese,
John R. Guttmann,
John R. Haswell,
Charles W. Henderson,
George F. Heubeck,
Ralph Holbrook,
Andrew C. Kemler,
Howard G. Lanahan,
George F. Lehmann,
Frank T. Leilich,
Harold M. Lewis,
Bernard A. McAbee,
Carl F. Meyer,
Sidney D. Mitchell,
Ferdinand Oppenheimer,
John G. Pertch, Jr.,
Lewis W. Porter,
John T. Ridgely,
John C. Schirmer,
Edward K. Stembridge,
David B. Stewart, Jr.,
Levin H. Stewart,
Irael E. Stolberg,
Frank T. Suman,
Nicholas C. Thalheimer,
Raymond M. Weaver,
George F. Wennagel,
George F. Weighardt,
Phillip H. Williamson,
Walter B. Wills.

CLASS OF '07.

Theodore Ascherfeld,
Ludwig Aull,
Emil G. Bauersfeld,
R. M. Bealer,
Alvin M. Bland,
Gustave Bornscheuer,
J. Daniel Brendel,
John N. Childs,
Wilmer A. Dehuff,
C. Lehman Downs,
Herbert S. Fairbank,
F. Donald Fenhagen,
Otto A. Geumann,
Charles E. Grimes,
Henry R. Gundlach,
G. Herman Guttmann,
Carroll R. Harding,
William Hartman,
Horace K. Hayden,
Harry L. Hess,
F. Merrill Hildebrandt,
Fernando Janer,
Harry B. Joyce,
John P. Kenney,
Charles Krausse,
W. H. Kruger, Jr.,
William G. McLaughlin,
Laurence F. Magness,
J. C. Manning,
Lawrence G. Miller,
Charles E. Mitchell,
Serafin M. Montesinos,
George T. Mumma,
Marcus Newhoff,
Samuel P. Nixdorf,
Artur Norden,
Edwin H. Nordmann,
Charles J. Rasch,
Charles J. Ritterhoff,
Ernest Rodemeyer,
Arthur H. Schultz, Jr.,
Nelson Schuster,
Frederick B. T. Siems,
V. Bernard Siems,
Charles Silver,
Samuel F. Tapman, Jr.,
T. Leonard Walter,
Berdnard Wich,
R. Mason Wilhelm,
Julius Zieget,

CLASS OF '08.

Otto E. Adams,
Gelston H. Armstrong,
Clarence P. Bolgiano,
Gilbert F. Bolgiano,
Emmet B. Bryan,
Joseph D. Bullock,
Nathan R. Butler, Jr.,
Walter S. Byrne,
James R. Carroll, Jr.,
Thomas D. Conn,
Percy Davenport,
Franklin Davis,
Arturo Diaz,
Austen Gailey,
Frank Goldenberg,
Eugene E. Graham,
T. Douglas Gresham,
R. Milton Hall,
Walter L. Heathcote,
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